AGRICULTURAL *Chemicals*

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- New Pesticides
- Manufacturing Fertilizer
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- Soil Produced Superphosphate
- Biological Insecticides
- New Sparger Design
- Cotton Production Report

JANUARY, 1959

Architect's rendering of the new Bagpak plant in Litchfield, Ill.

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your most dependable source of supply . . .

INTERNATIONAL PAPER

BAGPAK DIVISION, N.Y.17, N.Y.

This Month's Cover

Top photo: Comparing height of normal soybean plants with those in the center which have been greatly dwarfed and yellowed by the parasitic round worm, soybean cyst nematode.

Lower photo: Field survey crew collecting soil samples in the potato growing area of New York State. (Inset) Photomicrograph of soybean root with H. glycine cysts attached. Cyst at lower right has egg mass attached.

Vol. 14, No. 1 January, 1959

AGRICULTURAL Chemicals

ARTICLES

FEATURES

MEMBER AUDIT BUREAU OF CIRCULATIONS

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National Agricultural Chemicals Association, Association Building, 1145 19th St., N.W., Washington, D. C. Lea Hitchner, exec. sec.

National Plant Food Institute, 1700 K St., N. W., Washington, D. C. Paul Truitt and Russell Coleman, executive vice-presidents.

Regional Offices listed on page 121.

American Potash Institute, 1102 16th St., N.W., Washington 6, D. C. H. B. Mann, president.

American Society of Agronomy, 2702 Monroe St., Madison Wisc. L. G. Monthey, executive secretary.

American Phytopathological Society, S. E. A. McCallan, secretary, Boyce Thompson Institute, Yonkers, N. Y.

American Chemical Society, 1155 16th St., N. W., Washington, D. C.

Association of Official Agricultural Chemists, P. O. Box 540, Benjamin Franklin Station, Washington, D. C., William Horwitz, secretary-treasurer.

Agricultural Ammonia Institute, Hotel Claridge, Room 305, Memphis, Tenn., Jack Criswell, executive vice president.

American Society of Agricultural Engineers, F. B. Lanham, secretary, 505 Pleasant St., St. Joseph, Mo.

Carolinas-Virginia Formulators Association, 516 S. Salisbury St., Raleigh, N. C. Hugh Horn, secretary-treasurer.

California Fertilizer Association, Sidney Bierly, executive secretary, Suite 1, Boothe Building, 475 Huntington Dr., San Marino, Calif.

Chemical Specialty Manufacturers' Association, 110 East 42nd St., New York City, Dr. H. W. Hamilton, secretary.

Entomological Society of America, 1530 P. Street N. W., Washington, D. C., R. H. Nelson, secretary.

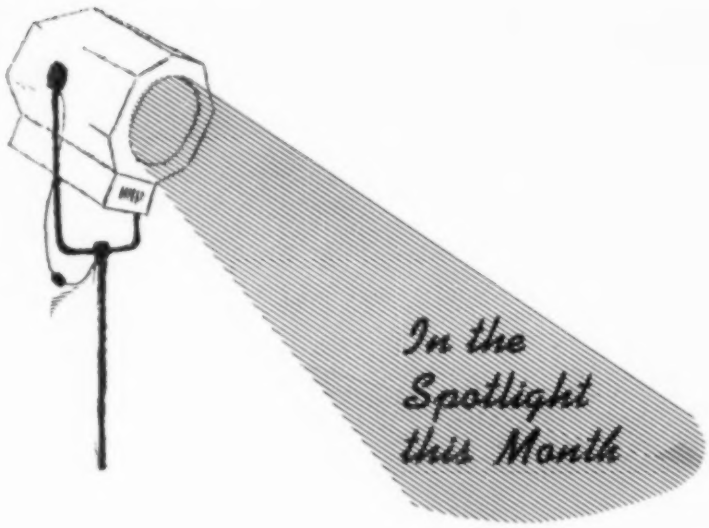
National Nitrogen Solutions Association, 2217 Tribune Tower, Chicago, Ill. M. F. Collie, secretary.

National Cotton Council, PO Box 9905, Memphis, Tenn.

Soil Science Society of America, 2702 Monroe St., Madison, Wisc. L. G. Monthey, exec. sec.

Weed Society of America, W. C. Shaw, secretary, Field Crops Research Branch, Beltsville, Md.

Western Agricultural Chemicals Association, Charles Barnard, executive secretary, 2466 Kenwood Ave., San Jose, Calif.



- **Fertilizer Production** . . . The conclusion of AGRICULTURAL CHEMICALS' report of the Fertilizer Industry Round Table meeting reviews discussions on ammoniation techniques, selection of an ammoniating plant, recycle and cooling techniques, use of steam in granulation, formulation of 3,2-2 and 2-1-1 grades and techniques in adding phosphoric acid to the ammoniator. Page 35.

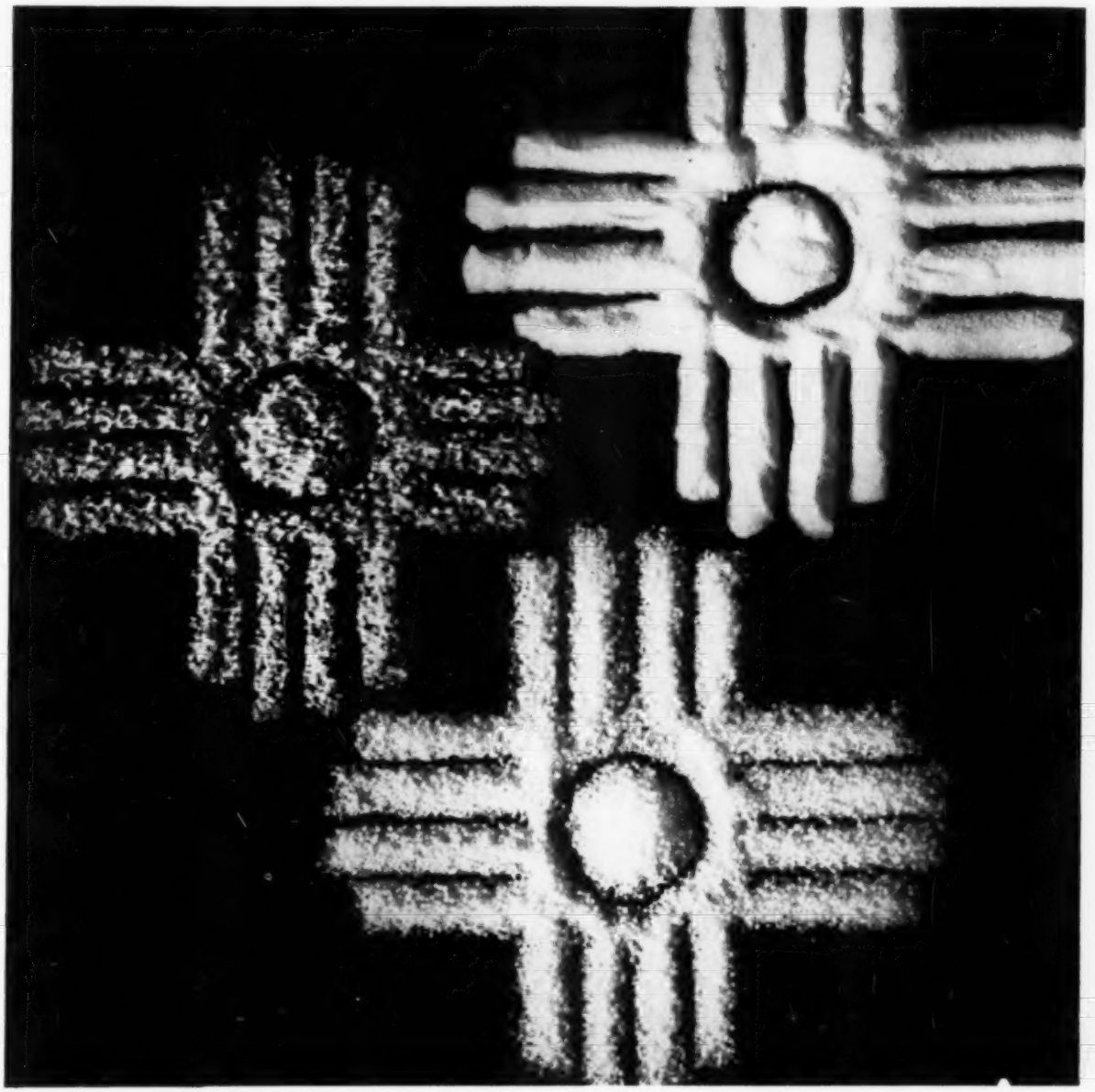
- **Microbial Pest Control** . . . The non-toxic nature of insect pathogens for control of other forms of life (and thus absence of toxic residues) is one of the more attractive features of this new approach to pest control. Page 45.

- **Soil Superphosphate** . . . "Soil Produced" superphosphate made by applying rock phosphate to the soil in bands, then adding either sulfuric or phosphoric acid directly to the band of rock has practical limitations, although experimental results were good. Page 43.

- **New Pesticides** . . . Second installment in a review of new pesticides for 1959. Reviews in this issue cover: Cyprex, Sytam, Kelthane, Glyodin, Trolene, Phosphamidon, Herbisan and Terraclor. Page 28.

- **Nematode Problem** . . . About ten years ago, commercial nematocides were introduced on the agricultural chemicals market;—people using these new chemicals saw production jump 25 to 50%. Nematocides today are used on almost ¾ million acres, and use is increasing. Page 39.

- **Fertilizer-Pesticide Consumption** . . . USDA has just issued a statement on the consumption of commercial fertilizer — pesticides mixtures for the year ending June, 1956. About 552 tons of insecticides were incorporated in fertilizers in this period. Consumption for the year was 120,860 tons, down 40% under 1955. Page 42.



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Trade Listing

AGRICULTURAL CHEMICALS magazine
Wayne E. Dorland, publisher
Eleonore Kanar, editor
P. O. Box 31
Caldwell, N. J.
Telephone: CApital 6-5520

National Agricultural Chemicals Assn.
Lea Hitchner, executive secretary
Association Building
1145 19th Street, N. W.
Washington 6, D. C.
Telephone: STerling 3-2833

National Plant Food Institute
Executive vice presidents:
Russell Coleman and Paul Truitt
1700 K Street, N. W.
Washington 6, D. C.
Telephone: District 7-0225

The following are the regional offices of the National Plant Food Institute

Northeast Regional Office
Willard H. Garman, director
1700 K Street, N. W.
Washington 6, D. C.
Telephone: District 7-0225

Southeast Regional Office
Samuel L. Tisdale, director
1220 Healey Bldg.
Forsyth, Walton and Poplar Streets
Atlanta 3

Pacific Northwest District
F. Todd Tremblay, Representative
2350 27th Avenue, West
Seattle 99, Washington
Telephone: Garfield 1032

Western Regional Office
Dr. Richard B. Bahme, Representative
550 Kearny Street
San Francisco 8, California
Telephone: Yukon 2-8173, 2-8174

Southwest Regional Office
Dr. Robert L. Beacher, Director
Route 8, Township Road
Fayetteville, Arkansas
Telephone: Hillcrest 2-4552

Midwest Regional Office
(Formerly Middle West Soil Improvement Committee)
Zenas H. Beers, director
228 North La Salle Street
Chicago 1, Illinois
Telephone: State 2-9361

MEETING CALENDAR

Jan. 6-7 — Texas Fertilizer Conference. Texas A.&M., College Station, Texas.

January 7-8—Fertilizer Short Course at Iowa State College. Sponsored by Iowa Extension Service. Ames, Iowa.

Jan. 7-8—Insect Control Conf., Mississippi State University, State College, Miss.

Jan. 7-9 — Northeast Weed Control Conference. Hotel New Yorker, New York.

Jan. 9-10—Association of Southern Feed and Fertilizer Control Officials. Velda Rose Motel, Hot Springs, Ark.

January 12-13 — Ohio Pesticide Institute. Annual winter meeting. Neil House, Columbus, Ohio.

Jan. 13-14—Annual Meeting, Georgia Plant Food Educational Society, meeting jointly with the Georgia Agronomists and the Georgia section of the American Society of Agronomy. Georgia Center for Continuing Education, Athens, Ga.

Jan. 14-15 — 11th annual Pesticide School, College Union Building, North Carolina State College, Raleigh.

Jan. 20-22, 1959 — California Weed Conference. Santa Barbara, Cal.

Jan. 20-23—Western Cooperative Spray Project. Benson and Imperial Hotels, Portland, Ore.

Jan. 21-22—Northwest Agricultural Chemicals Industry Conference. Benson Hotel, Portland, Ore.

Jan. 22-24 — Agricultural Aircraft Association, Senator Hotel, Sacramento, Calif.

Jan. 26-30 — Pennsylvania Agricultural Extension Conference, Pennsylvania State University, University Park, Pa.

January 25-30 — Purdue Pest Control Conference. Purdue University, Agricultural Hall, Lafayette, Indiana.

Jan. 27-28—Soil Sciency Society of North Carolina. Williams Hall, N. C. State College, Raleigh, N. C.

January 28-29 — Illinois Custom Spray Operators' Training School, University of Illinois, Urbana, Ill.

January 29-30 — Colorado Agricultural Chemicals Association. Cosmopolitan Hotel, Denver, Colo.

January 30-February 1 — Eastern School of Retail Management and Trade Show (formerly the Garden Supply Trade Show). Hotel Statler, New York City.

Feb. 4-5 — National Plant Food Institute Traffic Committee meeting. The Chase Hotel, St. Louis, Mo.

Feb. 11-13—Pennsylvania Lime and Fertilizer Conference. Pennsylvania State University, Nittany Lion Inn, University Park, Pa.

Feb. 12-13 — Midwestern Agronomists, Fertilizer Industry Representatives, 11th annual meeting. Edgewater Beach Hotel, Chicago, Ill.

Feb. 13 — Winter meeting, Executive Committee of the Fertilizer Section, National Safety Council. Heart of Atlanta Motel, Atlanta, Ga.

Feb. 10-12 — Texas Agricultural Chemicals Conference. Texas Tech College, Lubbock, Tex.

Feb. 24-25—Alabama Pest Control Conference, API campus, Auburn, Ala.

Mar. 17 — Spring Meeting of Western Agricultural Chemicals Association, Hotel Miramar, Santa Barbara, Calif.

June 9-10 — Seventeenth Annual Convention of the Association of Southern Feed and Fertilizer Control Officials, Velda Rose Motel, Hot Springs, Arkansas.

July 7-9 — Pacific Northwest Plant Food Assn., 10th annual Regional Fertilizer Conference, at Tacoma, Wash.

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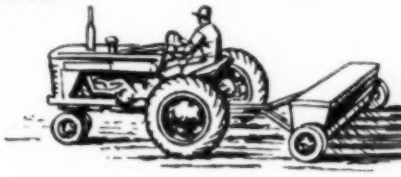

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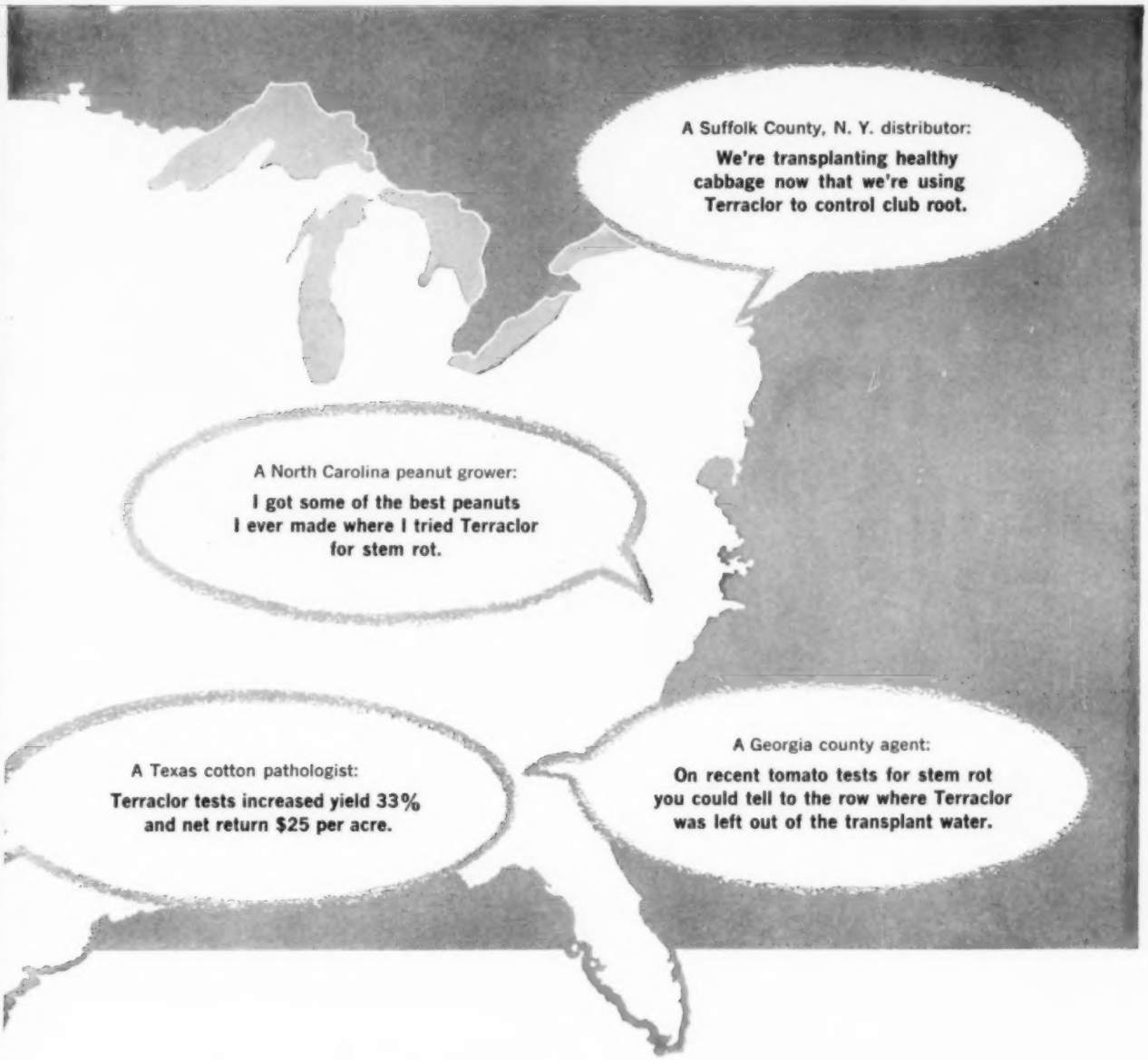
BEANS: Root and stem rot losses run as high as 30-40%. Terraclor may increase yields by 200-300 lbs. per acre and return growers 10-15 times the cost of treatment. Terraclor also controls white mold.



TOMATOES, PEPPERS: Stem rot (Southern blight) can cut production 30-60%, depending on severity. Terraclor treatment can return 10-20 times the investment by increasing yields ⅓ to ½.

LETTUCE: Growers have lost 25-50% of their crop to leaf drop and bottom rot. Terraclor may increase yields by ½ for a profit far exceeding the chemical cost.

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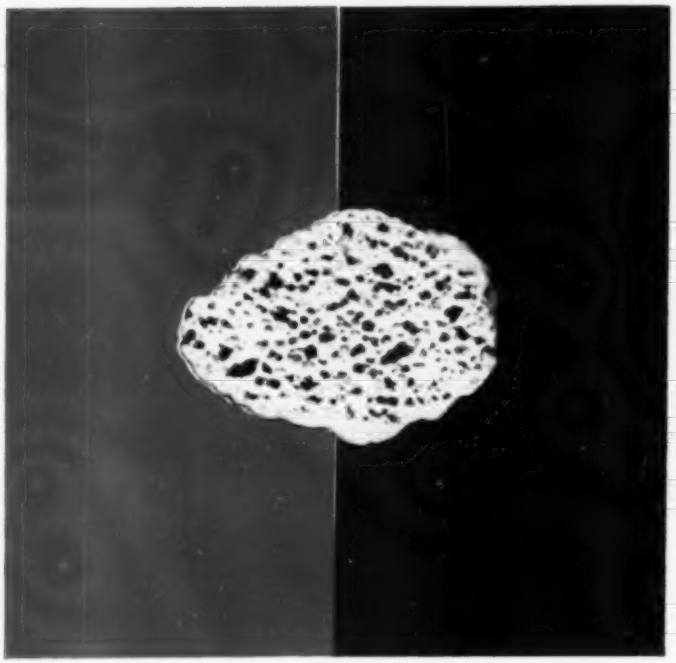

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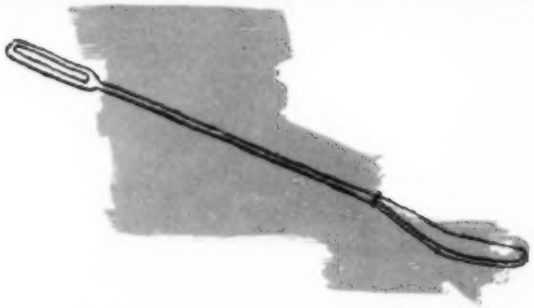

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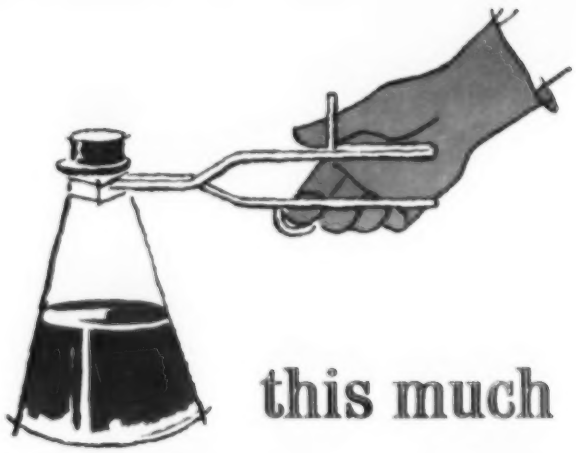

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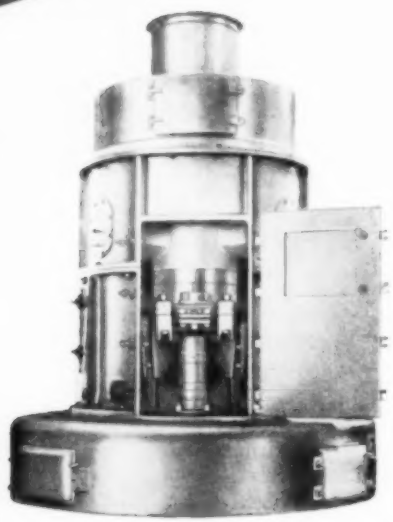

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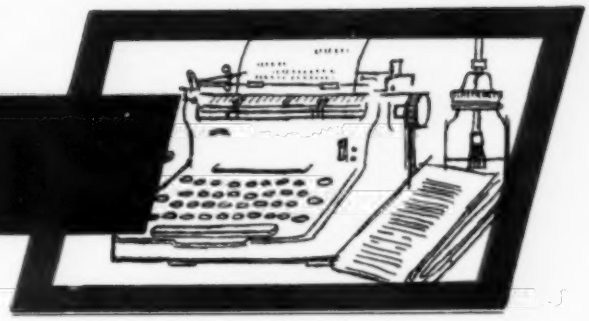
EDITORIALS



AT this time of the year, when thought is conventionally supposed to be given to new resolutions, it would seem to be highly appropriate in our own industry to give some serious consideration to the general subject of meetings and arrangements for them. To begin with, it is rather obvious that there are far too many meetings. Members of this magazine's staff attend somewhere between thirty and forty meetings each year, and we could readily go to twice that number. For many of the companies in the agricultural chemical field who must also cover a high percentage of this list—often with as many as eight or ten men—the task of attendance is a big drain on man power and a big item in the travel budget. And many, we fear, simply "put in an appearance," not so much with any feeling that they are going to learn anything or contribute anything, but rather from a fear that their absence would be noted.

With so many meetings, conflicts are almost unavoidable. It is surprising to us that more direct conflicts do not occur. The obvious way to prevent conflicts, of course, is to have some central listing agency with which meeting dates could be registered. The first registrant would have priority, and responsibility for conflict would then rest clearly with any second group trying to utilize the same meeting date. *Agricultural Chemicals* would be happy to act in this capacity, to help avoid confusion.

Another point which deserves consideration is trying to arrive at touching dates for meetings of affiliated groups. In the past few years we have run into several examples of a meeting being held by a particular group in one city, and then two or three days later practically the same group being called back a thousand miles or so, to attend another meeting in the same general area. A little better planning could obviously have eliminated a long, expensive and time-consuming extra trip.

Finally, we feel that when any major organization calls a meeting at which they expect attendance of several hundred busy trade and technical men, they owe them an obligation to

(*Continued on Page* 121)

IT is becoming increasing obvious that there is a concerted campaign under way by wildlife groups to level a strong attack at every area-wide pest control program that is started. Latest to come under attack is the fire ant program. The National Audubon Society not only opposes the particular pesticides used and the methods of application, but also actually questions whether there is any need to take any action to contain this pest. They suggest that perhaps the fire ant may do about as much good as harm, and call the idea of eradicating a major pest a practical impossibility.

Their attention should be called to the highly successful campaign in Florida a few winters back against the Mediterranean fruit fly. This dangerous invasion was completely stamped out by prompt and effective action. Not only growers, but also every consumer of citrus products as well, will share the benefits of this program for years. It is clearly much more efficient to get rid of such pests rather than to have to learn to live with them.

It is certainly to be hoped that those officials in the USDA responsible for initiating such pest control programs will not be intimidated by pressure campaigns such as have been launched, but will continue to move against our insect enemies wherever and whenever they detect an enemy that should be combated.

Phosphamidon-Systemic Insecticide

PHOSPHAMIDON, which will be available in limited quantities in 1959 from California Spray Chemical Corp., Richmond, Calif., is a systemic insecticide for control of aphids, mites, certain beetles, plant bugs, lepidoptera larvae and other insects. Formulated as a 4 pounds/gallon water soluble liquid, Phosphamidon 4 Spray will be packaged in ½ pint, 1 pint and 1 quart bottles. It is corrosive to, and decomposed by iron, alkaline materials and some metals. It should be protected from moisture, and must be stored in glass, polyethylene containers or plastic lined metal containers.

Chemically, Phosphamidon is 2 - chloro - 2 - diethylcarbomoyl - 1 - methylvinyl dimethyl phosphate. It acts mainly as a systemic toxicant with relatively active spray contact action. The surface residual action is extremely short and thought to be unimportant as a mode of action. It has been shown to be effective against both sucking and chewing insects. The full effect on these pests generally becomes evident 1 to 3 days after application. Aphid control has been particularly outstanding. Calspray suggests that Phosphamidon be tested against established infestations and in regular spray programs as a preventive insecticide and as a systemic toxicant.

Phosphamidon may be applied to plants, either dilute or concentrate, by standard spray methods. It may be added to the soil and thus absorbed by the roots;—or it may be applied in a concentrate form by means of bandages around the trunks of trees and absorbed directly into the conductive tissues.

At use-dosages, Phosphamidon is reported to be quite non-phytotoxic to most growing crops. The actual degree of phytotoxicity to the plants on which it will be tested in the U.S. is unknown, and careful observations should be made. The LD_{50} to rats is 50 mg/kg.

Users should be cautioned that Phosphamidon is poisonous if swallowed, inhaled, or absorbed through the skin. Usual precautions in handling organic phosphates should be observed.

A Miticide-Kelthane

A NEW miticide, Kelthane (1,1-bis (chlorophenyl) - 2,2,2 - trichloroethanol), has been used extensively in 1958 and will be available in 1959 as a wettable powder and an emulsifiable concentrate. The wettable powder contains 25% of the technical material, equivalent to 18.5% of the active ingredient; the emulsifiable concentrate contains two pounds of the technical material per gallon, or 1.5 pounds of the active ingredient per gallon. Rohm & Haas Co., Philadelphia, basic manufacturer of the material, points out that Kelthane is especially toxic to motile forms of mites, and is ovicidal to some species. Kelthane has given effective control of a very wide range of mite species, and of populations which have become resistant to the organic phosphates and other miticides. It is essentially non-toxic to insects, including honey bees. Kelthane is also reported to be safe on all crops under most environmental conditions.

Kelthane has a comparatively low order of mammalian toxicity, being about one-third as toxic as DDT. The acute oral LD_{50} to rats is 809 ± 33 mg/kg. Kelthane wettable powder does not cause skin irritation, and is not absorbed through the skin. Kelthane emulsifiable concentrate will cause skin irritation, and is absorbed through the skin.

Kelthane formulations have presented relatively few compatibility problems. They are similar in this respect to DDT and other chlorinated hydrocarbon formulations. In general, there is no difficulty combining Kelthane wettable powder with other wettable pesticides, and likewise no difficulty in combining Kelthane EC with other pesticides which are satisfactory for use with emulsifable solvent-based formulations.

Kelthane residues are very persistent and remain on the crop for a long period of time before disappearing completely. However, the total residues present are not high. Under normal use conditions, even with applications fairly close to harvest, residues seldom exceed

Pesticides

1 or 5 ppm, and are usually much less.

The most important markets for Kelthane are in the deciduous fruit growing areas, citrus in Florida and California, and cotton and vegetable and field crops in irrigated farming areas.

Carbide's Fruit Fungicide

GLYODIN fruit fungicide, a liquid solution of 2-heptadecyl glyoxalidin acetate in isopropanol, has been on the market for several years, and is sold by dealers to growers throughout the apple and cherry-growing areas of the country. It is manufactured by Union Carbide and Carbon Corp., New York.

A tolerance has been established under the Federal Food, Drug and Cosmetic Act which permits the sale of apples, cherries, and peaches bearing probable Glyodin residues, when the material is applied in accordance with label directions. The maximum probable residue (and the tolerance) is five parts per million, by weight of fruit. The usual residue at harvest, as reported by Union Carbide research, is less than 1 ppm.

Glyodin is recommended in dilute sprays as a protective fungicide for the control of scab, sooty blotch, brooks spot, bitter rot,

black rot and fly speck of apples and pears, leaf spot of cherries, brown rot of peaches, and certain fungus diseases of ornamentals. It suppresses mites, and through its spreader-sticker action, it increases the effectiveness of certain insecticides in combination sprays. It is suggested for both early and cover sprays. Users are said to get back-action plus protection by using Glyodin with mercury.

for '59

Part 2

Continuation of the "Agricultural Chemicals" review of new pesticides. This issue contains discussion on: Dibrom, Glyodin, Cyprex, Phosphamidon, Herbisan, Terraclor, Trolene, Sytam, PRD experimental Nematocide, Dimethoate, 2,3,6-T.

In February, the series will be concluded with a report on Korlan, Phaltan, Dowicide A, Sevin, Trithion, Tedion, HCA, Simazine, Ethion, Thimet, Dyrene, Phostex, Thiodan, DEF, and Eptan.

Organic Phosphate Insecticide

SYTAM is the Pennsalt trade name for a product containing four pounds of technical schradan per gallon. Schradan is the generic name for octamethyl pyrophosphoramide, also known as OMPA. Pennsalt Chemicals Corp., Tacoma, Washington, indicates the material will be available in commercial quantities during 1959 for use on English walnuts for control of the walnut aphid.

Schradan has also been registered for use on ornamentals and non-bearing fruit trees for control of aphids and mites.

A tolerance has been obtained from the FDA by Pennsalt Chemical Corp. for .75 ppm schradan on English walnuts.

Sytam, a water-soluble organic phosphate, is absorbed by the foliage of plants and is translocated within the sap stream to other parts of the plant, particularly new terminal growth. There is little lateral translocation, however, so that uniform coverage of the entire plant is usually necessary for best results. There is evidence that a film type coverage is not absolutely necessary, but it is apparent that each leaf should have a uniform quantity of toxicant whether applied by conventional dilute spray or by semi-concentrate method.

Experimental results indicate that 1½ pints of Sytam per 100 gallons should give control of aphids and mites; for heavy infestations, 2 pints should be used. Best results are obtained when Sytam is used as a preventive spray, rather than after infestation has begun.

Because schradan is a systemic phosphate type insecticide and an acaricide, it should be handled similarly to parathion and other cholinesterase inhibitors. Users should be cautioned to take care in handling.

Herbisan—A Herbicide

HERBISAN 5, a herbicide offered by Roberts Chemicals, Inc., Nitro, W. Va., is suggested primarily for use against weeds in onion crops both pre and post-emergent. The USDA has registered Herbisan for the use on onions, based on no residue. This approval stems from work done using radio active tracer techniques which showed no residue on onions and other crops such as peppers, potatoes, corn, soy beans, field beans, and spinach. Only the work on onions, however, was sufficiently sensitive to warrant a no residue registration. Approval on the other crops is expected in the near future, according to Roberts.

The active ingredient of Herbisan is bis ethyl xanthogen. It is available as an emulsified concentrate, 5 lbs. per gallon active. It is ready to use after diluting with water. For pre-emergent use, an application of 2 gallons in 50 to 100 gallons per acre, one to two days before crop emerges is suggested. Potatoes can be sprayed 2-4 days after emergence.

Herbisan is not corrosive and can be washed out of equipment. It is not harmful to the operator, and does not irritate or stain the skin.

Roberts Chemicals indicate that one outstanding feature of Herbisan is that in almost every case of use, improved yields have been obtained . . . whereas with most weed control materials, yields are affected adversely.

Trolene for Cattle Grub

TROLENE is a systemic insecticide applied orally for cattle grub control. Promising results of exploratory work with Trolene (Dow-ET-57) were first announced in the spring of 1956 by the U. S. Department of Agriculture and The Dow Chemical Company of Midland, Mich.

Trolene has a comparatively low mammalian toxicity and yet is highly toxic to parasitic arthropods. For example, the single dose LD_{50} for rats is approximately 3,000 mgm/kg of body weight. The LD_{50} in rabbits is around 1000 mgm/kg and in chickens between 4,000 and 5,000 mgm/kg. Five hundred mgm/kg of body weight has been administered to cattle with no deaths occurring. Hogs have been given 60 mgm/kg per day for 30 days with only depression in weight gains being noted. The material has a low acute toxicity by skin absorption, with LD_{50} in rabbits being in the range of 1500 to 2000 kg of body weight.

Federal registration of Trolene (O,O-dimethyl O-2,4,5- trichlorophenyl phosphorioate) as a

new drug and as an insecticide available for sale in bolus form was obtained in September of 1957. The chemical was then made available for sale in bolus form in the Central Plains region and in parts of Canada. Veterinarians throughout the United States and Canada can obtain boluses through Pitman-Moore, Indianapolis, Indiana, or through their normal sources of animal health products.

Treatment should be made as soon as possible after the end of the heel fly activity. The fly seasons will vary with local conditions, so the local agricultural authorities should be consulted.

Recommended dosage is one bolus, for each 300 pounds of animal body weight. Trolene should not be given to lactating dairy cows, nor to beef animals within 60 days of slaughter.

Under a trial marketing program including Iowa, Nebraska, South Dakota, Wyoming and parts of Canada, 100,000 head of cattle were treated commercially and reports from livestock men showed an average of 90 per cent control.

Research studies and commercial applications have shown some instances of adverse side effect following treatment. These effects seemed transitory and passed quickly—usually within 24 hours. However, these side effects usually can be avoided if the recommendations for early treatment are followed. Early treating also shows best grub control and stops the grub before meat or hide are damaged.

Animals should have a good feed and water supply available before and after treatment. Animals in a dehydrated condition or under a nutritional stress should not be treated.

A few instances of lingering illness following application proved due to throat damage from rough handling of the balling gun. There is no evidence to show that treating a sick animal with Trolene will make the illness any more severe. However, as a general rule, sick animals should not be treated.

The Soil Fungicide Terraclor

ALTHOUGH it is not a 1958 development,—the soil fungicide Terraclor should be mentioned in this review of pesticides. (A full report on this product appeared on pages 30-32 in the July 1957 issue of *Agricultural Chemicals*).

The active ingredient of Terraclor is pentachloronitrobenzene. It is made by Olin Mathieson Chemical Corp., Baltimore, Md., and suggested for the control of soil-borne diseases of cotton, crucifers, peanuts, tomatoes, peppers, beans, lettuce, potatoes, legumes, wheat, garlic, and ornamentals.

The material is completely soluble in ketones and aromatic and chlorinated hydrocarbons, slightly soluble in alkanols and insoluble in water. It has good residual action,—field demonstrations indicate the material retains its activity for as long as 12 months after application.

Terraclor is not a highly toxic chemical. The acute oral LD_{50} to rats when pentachloronitrobenze is administered as an aqueous suspension of a wettable powder is greater than 12 gms per kg.

Olin Mathieson recommends that correct application of Terraclor be made. The following means are suggested: soil mix, surface application, transplant solution, or seed treatment.

Ideal Apple Fungicide

A NEW fungicide, developed by American Cyanamid Co., New York, introduced to the trade under the brand name Cyprex (dodecylguanidine acetate) will be available to growers in the major fruit areas early in 1959.

In announcing the new product, Dr. J. F. Yost, director of plant industry development for the Agricultural Division, praised the fungicide for its excellent eradication and protection properties and its unique ability to penetrate apple leaves.

Cyprex was formerly known under the experimental number E. F. 5223 and underwent three years of field testing by leading plant pathologists in federal and state experimental stations. Those directly involved with the field testing have acclaimed Cyprex as approaching the ideal apple fungicide.

Apple scab is one of the greatest problems to fruit growers, and it is against this disease that Cyprex has been most widely tested. Under the most severe scab conditions (high moisture and mild temperatures) the new fungicide has given near-perfect control, outperforming several standard and experimental materials by substantial margins.

The present government clearance is for the control of apple scab through first cover sprays. Cyanamid completed two years of chronic toxicity studies in December which, together with extensive field studies, will be used to petition for a tolerance permitting later apple cover sprays as well as full season use on cherries and pears.

Other New Pesticides

SEVERAL other products announced during 1958, on which no additional information is yet available, should be commented on briefly in this review. They include:

PRD Experimental Nematocide

Developed through cooperative research by Boyce Thompson Institute and Diamond Alkali Co. for use in agriculture and on ornamentals, the material is available on a simple basis to qualified investigators at agricultural experiment stations for additional evaluation in nematode control applications.

PRD is identified chemically as 3,4-dichloro tetrahydrothiophene 1,1-dioxide. It has an acute oral

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Granular Herbicides for Aquatic Weeds

2,4-D pellets find promising market in control of weeds in lakes and ponds

Picture at top left shows lake in Jacksonville, Ark., after treatment with aquatic herbicide. Lower picture shows weedy view of the same lake before treatment.

ONE of the "hottest" new products in the agricultural chemical specialty field, which is currently attracting considerable attention, is granulated 2,4-D pellets for aquatic weed control. Only one company had such a product on the market last year, Reasor-Hill Corp., Jacksonville, Ark., but several other firms are reported to have similar products under consideration for the 1959 season. The herbicidal properties of 2,4-D are well known, but the new twist to the product now being marketed is that it is a granular rather than a liquid form, it drops to the bottom of the pond and kills effectively by entering the root structure of the weed rather than by being dissipated in the water as liquid forms would be, and the relatively low concentration of herbicide employed causes no injury to fish or other animal life or to trees or shrubs on the banks of treated ponds.

A new variation of the product reported under consideration by a major supplier, and which may be on the market for the '59 season is a combination herbicide-fertilizer product which will not only kill aquatic weeds but will feed the pond as well,—a "weed and feed" combination. Since one major field for use of these new aquatic herbicides is the treatment of fish ponds, it is a logical extension of the idea to add a secondary material which will build fish population. Thus not only will the fish be more accessible to sportsmen through removal of the weeds, but there will be more fish as well.

Probably the first publication on the general subject was a short paper "A New Approach to the Control of Certain Aquatic Vegetation," by B. H. Grigsby, R. H. Hamilton and J. Smith, delivered at the 13th annual meeting of the North Central Weed Conference held December 10-12, 1956 at Chicago. They described studies conducted during the fall of 1955 and the spring of 1956 in which 2,4-D pellets at a rate equivalent to a concentration of 20 ppm completely eradicated a heavy underwater growth of milfoil from the bottom of a treated pond. The 2,4-D was applied in clay pellets on top of the ice, using a 3 ft. fertilizer spreader.

Reasor-Hill saw the possibilities in the material immediately and soon had a product on the market under the name, "Granular Weed Rhap" 20. It contains 20% by weight of 2,4-D acid in the form of its 2-ethyl-hexyl ester, incorporated in a heavy clay binder. The 2,4-D is esterified with 2-ethyl-hexanol and the resulting ester is blended with clay and pelletized in water. It is claimed that the resulting herbicide (1) controls these five aquatic weeds: elodea, milfoil, fanwort, tape grass and ludwigia (2) controls or retards emergent weeds such as lilies, cattails and alligator-weeds (3) greatly reduces many types of algae.

Reasor-Hill recommend applying the material on top of ice prior to melting in the spring for an easy and uniform application. A fertilizer spreader can be used, and the recommended rate is 100 lb. an acre. Later in the season it can be spread from a boat at the rate of 1

lb. to each 430 sq. ft. Complete eradication is said to proceed relatively slowly as compared with the effect of a spray on foliage in the normal non-aquatic application. However, complete kill is said to result, and the effect of the treatment is evident over a period of 12 to 36 months. Resistant perennial weeds are also eradicated. The pellets dissolve slowly, which serves to lengthen the period of kill while also reducing the possible hazard to fish and other animal life. Since the pellets drop to the bottom of the lake or pond, kill can be restricted to a small area and closely controlled.

Numerous tests have been conducted this past season in the Arkansas area in which Reasor-Hill Corp. operates, with the cooperation of the Agricultural Extension Service, the Soil Conservation and other agricultural agencies. D. L. Gray, extension wildlife conservationist, reports that on the basis of tests conducted in Hempstead County, the 2,4-D granules killed more weeds than other herbicides, and the dry pellets were safer to use than liquids previously employed. (Previous control measures which included the use of arsenicals, chlorinated benzenes and similar highly toxic materials have not been widely employed because of the hazards inherent in use of such materials.)

"Pellets are easier to apply than other chemicals recommended for aquatic vegetative control," said Mr. Gray, "and most demonstrations show far better results from the use of 2,4-D granules than from sodium arsenite."

Thomas W. Wright, biologist with the Soil Conservation Service, reported that "almost all" the submerged weeds were killed by the pellets in tests at Prescott, Ashdown, Texarkana and Magnolia. He said some of the ponds were so choked with weeds that fishing was next to impossible.

Robert J. Schramm Jr., assistant professor of horticulture at North Carolina State College, said a member of the faculty at the College owned a pond that was "completely overgrown" with parrot feather and elodea (two weeds that infest ponds in the area) but the plants were eradicated with one application of 2,4-D in pellet form.

"There was no evidence of any damage to the fish population or to trees growing on the banks adjacent to the pond edge," he said. "Cattle continued to drink from the pond with no ill effects."

Schramm said the college had not conducted enough research on the product to make specific recommendations but that he was suggesting the material as a remedy to weed problems in farm ponds.

Buford H. Grigsby of the Department of Botany and Plant Pathology at Michigan State University reported that he had conducted tests in the use of granular herbicides since 1956 and had found that the method was safe and effective.

Those interested in the new product look for a growing market among farmers and sportsmen. It is recognized that there are hundreds of thousands of lakes and ponds that it might pay to treat, but the obvious difficulty will be to open up the sales channels through to the eventual user. The distribution channels simply do not exist to tap the entire market, for there are many potential buyers and users who would not be reached by the typical agricultural chemical dealer.

The best season for sale of the product is anticipated to be fall and winter, for these are the recommended periods for application. Following a successful kill, the lake or pond will remain choked with dead vegetation for several weeks, until the natural processes of decay remove the debris. Thus it is recommended that applications be timed when the weeds are young, to minimize the waiting time for the product to take effect.★★

Label for Reasor-Hill aquatic herbicide, for control of cattail, milfoil, etc.

Handbook on Blue Chip Urea

Nitrogen Agricultural Chemicals, Division of Woonsocket Color and Chemical Co., Woonsocket, R. I., have just published a 20-page booklet, "Your 'Blue Chip' Fertilizer Program, Manufacturers' Handbook."

Copies are available from Dept. AC, Nitroform Agricultural Chemicals, 92 Sunnyside Avenue, Woonsocket, R. I.

Photo U. S. Forest Service

Lodgepole pine on highway in Boise N. F., Idaho, killed by insects.

FOREST PEST CONTROL

by Warren V. Benedict
USDA, Div. of Forest Pest Control
Washington, D. C.

Conclusion

Developments in Chemical Control

DURING the past 10 years, many new materials and methods for destroying destructive pests have been developed. For the control of certain bark beetles, effective new insecticides disolved in penetrating oils have been used successfully on large-scale control projects that would previously have been too costly to undertake. The insecticide formulation is applied as a spray to both standing trees and felled trees, depending upon the species of tree and species of insects involved. The equipment used in bark beetle control operations consists of power chain saws to fell, branch and limb the infested trees, and hand operated or power spray pumps for applying the insecticide to the bark of the trees. Where standing trees are treated, the stirrup pump and open-mouth container is extensively used. In 1958, over 100 outbreaks of destructive bark beetles were controlled by use of insecticides, and 326,600 infested trees were treated.

Insecticides are used also in the oak-wilt control program, to destroy the insect vectors that play a part in spreading the wilt fungus. The herbicides 2,4-D and 2,4,5-T are in wide use in destroying the alternate host *Ribes* in the program to control the white pine blister rust. These herbicides are applied by both large and small ground-operated power equipment and by hand spray outfits. The type and size of the ground equipment used depends upon the size, abundance and extent of the plants being treated.

Dispersal of Insecticides by Plane

THE discovery of the outstanding insecticidal properties of DDT in 1943 revolutionized airplane spraying. Here was a chemical that by previous standards was unbelievably toxic to many insects in very small amounts. It is soluble in fuel oil which serves as a very adequate carrier, flows freely and uniformly from spray nozzles without clogging. Small quantities of solution—one gallon per acre—are usually sufficient to give residual deposits that are lethal to some troublesome crawling insects for several weeks. When dosages do not exceed one pound of DDT per acre, and adequate precautions are taken to avoid spraying the insecticide directly into open lakes and streams, and to prevent overdosing in the treatment area, damage to forest life is slight. Here, then, was just what was needed to make control of destructive foliage-eating insects by aerially applied insecticides practical.

During the late war, military forces sprayed entire islands in the Pacific to destroy mosquitoes and other disease-bearing insects. When DDT and other new organic insecticides became available for civilian use, applications were tried on crops and forests. Results of the trials in forest spraying were so encouraging, that the insecticides have been put to wider use each succeeding year. Since 1947, more than 10 million acres of forest lands in the United States have been treated successively with DDT to combat epidemics of such foliage-feeding insects as tussock moth, spruce budworm, hemlock looper, pine saw-fly and Saratoga spittlebug. Currently, the aerial spray programs of the Forest Service are averaging around 1½ million acres per year.

The type of aircraft best suited for forest spraying and the equipment needed for carrying and releasing sprays of proper droplet

size at the desired rate have been the subject of much investigative and engineering work. Developments have been so rapid and are so specialized that they cannot be covered here adequately.

Many types of airplanes are now in common use in the aerial spraying of forest areas. They range from the small single engine Stearman, which can carry about 100 gallons of spray and operate at 75 to 90 miles per hour, to large multiple engine transports, such as the B-17 and C-82, which can carry up to 1800 gallons and operate at 150-plus miles per hour.

Most aerial spray jobs are handled by contract. The cost of applying DDT sprays to forests varies from 75 cents per acre to $2.50, depending on the type of terrain, size of the area to be treated, and distance from the landing strip.

Quantity of Chemical Used

THE following tabulation lists the quantities of pesticides used by the Forest Service during 1957 in pest control operations:

Pesticide	*Pounds*
DDT	1,500,000
Benzene hexachloride	200,000
Ethylene dibromide	46,000
Malathion	1,100
Orthodichlorobenzene	800
Chlordane	1,800
2,4-D and 2,4,5-T	7,000

A total area of 1,496,000 acres infested with spruce budworms was treated by aerial application at one pound of DDT per acre. Other projects involved DDT at the same rate against saw-flies, Great Basin caterpillars, Saratoga spittlebug, and cone and seed insects. The major use of benzene hexachloride was for the control of bark beetles by ground application at the rate of one to 1½ pounds per tree in southern and southeastern states. Ethylene dibromide was used mainly for control of bark beetles by ground application in the Rocky Mountain and Western states. Malathion was employed for the control of needle miners and pests of forest tree nurseries. Orthodichlorobenzene was used to control bark beetles in Colorado, New Mexico and South Dakota; and chlordane to control forest tree nursery pests. The weed-killers 2,4-D and 2,4,5-T were applied in programs for the control of blister rust and oak wilt diseases. While final data are not available for 1958, consumption of pesticides was likely about the same.

Control of forest pests by direct measures, involving use of toxic chemicals has been generally effective in reducing outbreaks from epidemic to endemic levels, and in restoring nature's balances. In the immediate future and for quite some years to come, we must look upon pesticidal control as our number one weapon for checking the huge drain inflicted upon our forests by destructive pests, in areas that are not currently ready for harvest.

Organization of Forest Pest Work

FORESTRY agencies in most sections of the country are now organized to handle direct control operations. Where substantial acreages of state and private lands are involved, control is carried out cooperatively under the provisions of the Federal Forest Pest Control Act of 1947, the Lea Act of 1940, and complementary state forest pest laws. Most states, with significant amounts of forest lands, have passed legislation authorizing appropriate State officers, such as the State Forester, to control forest pests. In general, authority is granted to declare forest pests a public nuisance and require land owners to dispose of such pests either by themselves or with the help of State and Federal authorities.

The Federal Government pays the entire control cost on Federal lands. Where the Federal Forest Pest Control Act applies, the Federal Government can pay part of the cost of control on non-Federal lands. Where control work on private lands is done in accordance with state authority, the costs may be met in part by state funds. The Federal Pest Act is not mandatory or regulatory. It is a great help in unifying methods and coordinating action.

Expenditures for control of forests in 1957 by State, private and Federal agencies totaled about seven million dollars.

Problems in Forest Pest Control

THERE are numerous special problems in connection with a pest control operation.

First are the problems of detection—you must first locate the bug or blight before you can combat it. The 488½ million acres of forest land of this country, much of it mountainous, is a vast domain in which to devise and maintain complete detection coverage. And, searching out dangerous pest situations in their incipient stages is rendered more difficult, because there is no tell-tale column of smoke to pinpoint the danger areas, such as is the case with fire. Nonetheless, there are many tangible trouble signs that are clearly evident to the trained technician. Both aerial and ground surveys are now conducted annually over most of our forested land, by private, State and Federal forest personnel, all working together on this important phase of the control job.

Another special pest control problem is to decide when direct control action, by use of pesticides is necessary. It is difficult to evaluate all the complex biological and ecological factors that normally hold pests in check and to predict accurately when these natural controls will cause an epidemic to subside. A good bit of judgment, by forester, entomologist and pathologist is needed, along with much field data, to arrive at an educated appraisal of an abnormal pest situation.

Still another problem relates to how much area is in need of chemical control—where to draw the line between the treatment area and the untreated area—an ab-

(*Continued on Page* 117)

Fertilizer Industry Round Table

Second part of Agricultural Chemicals' report on the 1958 Fertilizer Industry Round Table meeting, held November 5-7 at the Mayflower Hotel, Washington, D. C., 1958.

Fume Formation

THE problem of fume formation and nitrogen loss was reviewed by G. L. Bridger, Davison Chemical Co., who observed that a plant can have serious fume problems, and still not have excessive losses of nitrogen. It doesn't take much fume formation to present a very substantial problem. It is necessary to prevent overheating of the fertilizer 100%, continued Dr. Bridger, because even 1% overheating can cause serious fume formation.

In a comparison of co-current and counter-current drying, Dr. Bridger observed that in co-current drying, the inlet air temperature is high, meets the inlet fertilizer material at its highest temperature, and fume formation may be caused by:

1) overheating of fertilizer material which builds up on louvres
2) overheating of fine particles of the inlet materials which are suspended in the inlet hot air
3) overheating of back spill of fertilizer into the furnace itself.

In the counter-current dryer, the air temperatures at the material inlet end are considerably lower than in co-current; materials are fed into the cold end of the dryer, and fine particles are not suspended in the hot air. Even if fertilizer material sticks to the louvres, that end of the dryer is cold, and there is no overheating.

A comment by another round table participant indicated that some of the fume problems could be avoided by using clean secondary air.

Economics of Processing

INTRODUCING the subject of processing economics, George F. Sachsel, Battelle Memorial Institute, observed that modern processing costs consist of several large items, including labor, utilities, supplies, capital, and other factors, depending on the accountant who sets up the cost system. There is probably only one really good general principle of processing economics, he said: that a processing operation should yield a return on investment that is at least commensurate with the risk.

Some figures on process labor data and process power data given by Mr. Sachsel are listed below:

	Labor Data		Power Data	
	man-hours/ton	$/ton	kwhr/lb	$/ton
furnace phosphoric acid	1.00	1.40	1.011	38
superphosphate	.60	1.05	.011	.22
furnace phosphoric acid	.80	1.40	1.9	38
nitric acid	1.00	1.75	.19	3.8
Dorr phosphoric acid	1.7	3.0	.053	1.06
KCl ex Sylvinite	4.3	7.5	.025	.50
ammonia			.75	15.

Discussion of Wet and Dry Scrubbers

REVIEWING the advantages and disadvantages of wet and dry scrubbers with relation to efficiencies, particle size recovery, etc., D. Bonn, American Air Filter Co., indicated that the advantages of a wet collector are that: it has greater flexibility, lower initial cost, maintains efficiency over entire operating range, and requires small space. Disadvantages of the wet collector are that corrosion protection is required; water must be disposed of; and certain grades will not take out the ammonium chloride. In a wet scrubber operation, there is little dust in the ammoniator, but considerable ammonium chloride fume formation; less material is carried over from the dryer than from the cooler, as compared with dry scrubber; on the other hand, an acid mist is given off in the mixer, which must be collected—often a packed tar handles this acid.

The Efficient Granulation Process

"TREMENDOUS advances by the process industries are being made in the use of control data and the application of instrumentation," observed Roger Smith, Eastern State Farmers Exchange, in reporting on "what control data should be collected by plant operators for the efficient operation of a granulation process." The two primary advantages, he said, are reduced labor costs or increased labor productivity, and improved product quality. Although the fertilizer industry has made effec-

tive use of certain control data, only limited progress has been made in the utilization of instrumentation.

Among the data which should be collected, is the moisture analysis of incoming materials, since this is needed for formulation and control of degree of wetness in the mixture. The screen analysis of dry ingredients is related directly to the screen analysis of granules formed, in addition to offering an indication of the ammoniation capacity of superphosphate.

Temperatures should be recorded at least at six points: fertilizer discharged from the ammoniator, the dryer, and cooler; and air ambient, and air temperatures from dryer and cooler. The ex-dryer air temperature is of particular value to control agglomeration and water removal.

Other useful data are routine product analysis, fuel input to dryer, air volumes required for dryer and cooler, total of each liquid metered during a day or shift, rate of water addition, relation of temperature to flow rate of viscous materials, etc.

Ammoniation Techniques

PRINCIPLES of ammoniation techniques which contribute to efficiency of operation were discussed by Elmer Perrine, Nitrogen Division, who said that in addition to their influence on economy, ammoniating techniques strongly influence the quality of pulverized fertilizer, and even the ability to granulate in extreme cases. Poor ammoniating techniques have been associated with some flash fires, and some fumes in addition to ammonia fires. They can quickly result in excess costs of nitrogen, superphosphates, and acid, and some bad fumes in addition to ammonia fumes.

Three factors, singly or combined, complicate the techniques of ammoniation beyond three or four pounds. For one, the mass becomes so warm, that much of the remaining ammoniation is performed by ammonia and gas—and gases react with dry materials more slowly than do liquids. Second, because the surface of the superphosphate particles has already been ammoniated, it is necessary to penetrate to the unreached superphosphate inside the particle. Superphosphate particles above 30-mesh ammoniate very slowly. The third factor is agglomeration, which further reduces contact of the superphosphate with the ammonia.

Major techniques offsetting the above problems rely on intimate and uniform contact between the superphosphate particles and ammoniating medium while ammonia is still in the liquid state. The simple practice of introducing the ammoniating medium at progressively slower rates as saturation is approached has been effective.

Discussing several ammoniators, Mr. Perrine pointed out that in either the continuous or the batch rotary mixer, the demand for ammonia is far from uniform per inch of length of the mixer. In the continuous TVA type ammoniator, throughout its length the volume of the mass is quite uniform,—but the rate of reaction with ammonia and the portion of the ammonia that will be gas, must be quite different between the inlet and outlet ends.

The ammonia distributor pipe must be considered as a manifold designed to accomodate the requirements. The holes should be so spaced, — or sized progressively, that they function as metering orifices. Since the rate of reaction decreases rapidly beyond the halfway point in high rates of ammoniation, there should be a corresponding decrease in the through /put of ammonia per hole in the distributor pipe in a batch mixer. Also in the continuous mixer, there should be a reduction in the number of holes or in their size toward the outlet end or some other means of coping with the changing demands of the process. In both systems, judicious handling of the gas portion of the ammonia can serve to even out the irregular ammoniation of superphosphate.

Selecting an Ammoniation Plant

J. Sharp, Spencer Chemical Co., offered the following summary of the important basic principles to be considered in the selection of a new granulation plant:

1. Steam is the most economical source of auxiliary heat and liquid phase when sufficient volume of grades are produced.

Photos (l. to r.):

R. V. Middaugh, J. Rushton, A. Mullin all of Indiana Farm Bureau; Walter Sackett, A. J. Sackett & Sons; L. M. Leach, and R. Leach, Indiana Farm Bureau; J. Sackett, and W. Henderson, also of the Indiana Farm Bureau.

W. Rohrer and L. Bridger of Davison Chemical Co.

R. H. Hessel and J. Iliff of Davidson-Kennedy Co.

2. Recycle is the most economical means of controlling excess heat and liquid phase.
3. A pre-neutralizer also helps control over-all heat and liquid phase, as well as reducing nitrogen losses.
4. Drying is often a bottleneck, and should have ample capacity provided. The flame should never come in contact with the material to be dried.
5. Screening should be done at the end of the dryer, and sufficient capacity provided.
6. The product should be cooled below 120° F. before going to storage.
7. Grades containing more than 300 pounds of ammonium nitrate should be coated with diatomaceous earth.

Three classes of fertilizer grades which vary in their heat requirements are 1) those requiring auxiliary heat and liquid phase other than that supplied from reaction; 2) grades which must be diluted to remove heat or the liquid phase generated in the course of reaction; and 3) grades in which the temperature and liquid phase are in correct balance for optimum granulation.

Since fertilizer grades in all three of the above classifications have to be produced to meet demand in most regions, the relative tonnage of the grades in each category will determine the optimum method of bringing about the correct heat and liquid phase balance.

Mr. Sharp observed that the trend in fertilizer production has been steadily toward higher concentration, because of several factors. For one, it costs just as much a ton to ship a high analysis product as it does for a low analysis fertilizer, and freight rates continue to increase. Second, other fixed costs, such as bags and handling, tend to increase the unit cost on low analysis fertilizer faster than on a high analysis product.

The trend toward higher concentration calls for the use of more liquid materials, like phosphoric acid and nitrogen solutions. The operator selecting equipment should keep in mind that equipment that is not designed to cope with high liquid phases will likely become obsolete before it can be amortized, he warned.

Recycle and Cooling Techniques

IN a series of comments on advantages and disadvantages of controlling recycle, when to cool the recycle, and screening between dryer and cooler, several opinions and experiences were exchanged. In the report just reviewed, Mr. Sharp noted that oversize should flow to a crusher and back into the dryer. Oversize particles are wet on the inside, he said, and should not be returned to the screen until the crushed material has passed through the dryer a second time. The onsize should flow to the cooler. The screen, he observed, should be of sufficient capacity to handle recycle, as well as finished product. Poor screening frequently is responsible for fines getting into the finished product. Also, it can cause the system to get off balance.

G. L. Bridger, Davison Chemical Co., indicated that a cool recycle is desirable for high nitrogen grades, but that a hot recycle is good for low nitrogen grades, for example 1-4-4. He reported that for all grades of fertilizers it is best to screen after cooling the product.

A. Henderson, Wilson & Toomer Fertilizer Co., observed that efficiency in an operation is a means of staying out of trouble, and that controlling all recycle is a most helpful factor in improving product quality.

The equipment for controlling recycle is quite nominal, stated Rodger Smith, Eastern States Farmers' Exchange. Essentially what is required is a hopper having capacity of about 25% hourly production rate, and a method of at least rough control of flow rate from the hopper. The hopper can be located immediately beneath the classification screen, or otherwise intermediate between the screen and the flow of material to the ammoniator-granulator. With batch mixing, a satisfactory arrangement is to use a bin above the weigh hopper into which a uniform amount of the fine recycle can be weighed in addition to the dry ingredients. Some means of rough control of the rate of flow from the hopper in a continuous system is necessary—i.e., within 5% accuracy. Provision must also be provided for easy adjustment of flow rate. Vibrating feeders commonly available at low cost, or a simple gate device, would be satisfactory.

The condition causing fines has to be adjusted to,—but time is provided to do this without halting operation, by some return feed arrangement. The improved product and improved operation far outweigh the nominal investment.

Steam in Granulation

THE plant foreman knows well that unless his operation is closely watched, the workers will dump more acid to assure granulating a difficult formulation. It granulates, of course, but it's very expensive.

H. Bosman, Federal Chemical Co., discussing economics of steam in granulation, observed that steam can be used effectively in granulating a grade such as 1-4-4 (which is difficult to granulate),—but fuel costs will average about 5 cents a ton. A further problem encountered is a high moisture in the end product, and therefore a high cost of drying. In test investigations using steam, one complication was a greater buildup on spargers, which was further aggravated by the steam, and caused the plant to close down. It is thought that hot water might prove to be a

more practical measure, but this idea is still under investigation.

Formulating 3-2-2 and 2-1-1

MAKING the fertilizer grades 3-2-2 and 2-1-1 is rapidly advancing the fertilizer industry into chemical processing and away from the conventional methods of manufacturing fertilizer, stated Elmer Perrine, Nitrogen Division, Allied Chemical & Dye Corp. Equipment, economics, safety and training of personnel includes much that is common to the chemical industry, he added.

The final cost of a ton of high-nitrogen fertilizer is influenced by many things beyond the original cost of the nitrogen. The combining of ammonia with superphosphate fixes the lowest cost nitrogen in the fertilizer, and the superphosphate should therefore be used at maximum efficiency. With 100% retention of the amount applied, 20% superphosphate should react with as much as 5.5 pounds of ammonia per unit of P_2O_5. Formulation should therefore use the maximum amount of 20% superphosphate for its influence on the cost of nitrogen, as well as for the usually lower cost of the superphosphate. Within reasonable limits, the ammoniating solution which contains the least free ammonia for unit of total nitrogen will be the most economical.

Sulfuric acid at the rate of 370 pounds has been used,—and even more is anticipated for good granulation and economy in the 2-1-1 and 3-2-2 grades. It is understandable, however, that some operators may look at this development with jaundiced eyes after their experiences with much lower amounts of acid in conventional processes.

Mr. Perrine referred to a suggestion made at the 1957 Round Table meeting favoring the practice of all the acid being mixed with the appropriate amount of nitrogen solution in a separate operation before introduction into the mixer that handles the ammoniation of the superphosphate and the other normal mixing operations. This process isolates the acid and nitrogen solution action, and permits controls that have proven satisfactory in operations that are quite routine elsewhere in the chemical industry.

Phosphoric Acid in Granulation

T. E. MARTIN, U.S. Industrial Chemicals, told the round table that several users of phosphoric acid are spraying or dripping it on top of the rolling bed in a TVA ammoniator. The advantage, of course, is that one sparger pipe less is required in the bed,—and the fewer such pipes, the less the interference with proper rolling and lifting action. There are several disadvantages in top feed, however, Mr. Martin said, including possible greater fume evolution, splashing, corrosion hazard and danger of accidents occurring. Still another disadvantage is that acid applied on top of the bed rolls down to the bottom quickly, and is then carried up the shell; thus reaction of the acid with ammonia tends to be delayed, and if enough acid wets the shell, there may be sliding of the bed instead of carry-up such as is necessary for mixer operation.

F. Nielsson, IMC, indicated that there is practically no fume formation when phosphoric acid is sprayed under the bed.

Commenting on the chemical and physical specifications of triple superphosphate, B. Tate, U.S. Phosphoric Co., listed the following:

available P_2O_5	49.47.5%
free acid	2.4.5%
water	3-5.5

He stated that in a fully integrated granulating plant ROP phosphate is recommended; in a semi-granulating plant, triple is preferred.

Preventive Maintenance

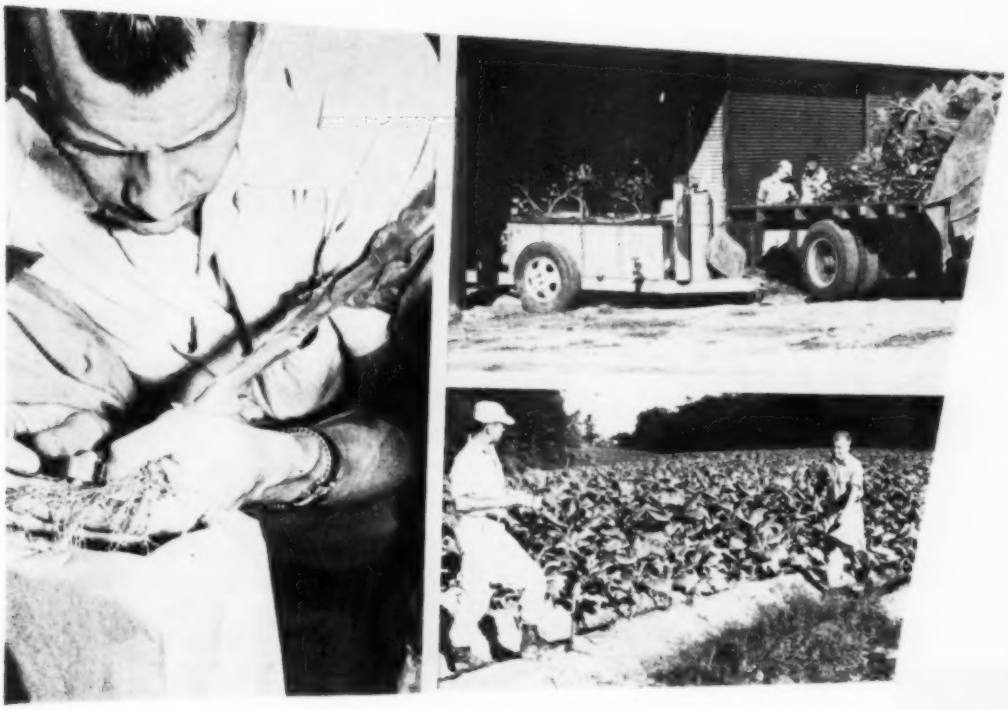
YOU can't make money unless you're in production,—and that means a planned program of preventive maintenance. This was the general theme of a discussion by superintendents and plant managers of factors involved in keeping a plant "on stream." The best engineered plant, with the best technical minds supervising production technique is effective only if it's operating,—and is completely wasted if "down time" is excessive and not prevented.

Jesse Jessen, E. I. du Pont de Nemours & Co., urged that plant foremen "get control of the job." There's no excuse, he said, for not having critical replacement parts in stock in the event of some breakdown . . . but even more important, he said, is a regular program for repair and maintenance. A good maintenance foreman will plan jobs to be done on a regular schedule. Thus unexpected breakdowns will be held to a minimum and costly delays avoided.

Walter Sackett, A. J. Sackett & Sons Co., observed that a process capable of maintaining its rated capacity without any excess down time will be a system that is well engineered, with every part operating at maximum efficiency. He urged that management, in purchasing new equipment, obtain all possible information on maintenance and overall cost. A unit with a high rated capacity, which requires high maintenance costs and is regularly under repair, is a poor investment. J. Proster, also of

(*Continued on Page* 115)

	ROP	Coarse
screen size	fine	coarse
surface area	high	intermediate
rate of ammoniation	3.5-4	2.5-3



THE NEMATODE PROBLEM

by Joseph F. Spears
Agricultural Research Service
Plant Pest Control Division
U. S. Department of Agriculture

INSECTS and plant diseases have been recognized for decades as the farmer's most important enemies. Problems in connection with the control of these pests are many and varied. Yet despite the progress that has been made in biological, ecological, cultural, and chemical control measures, our losses to insects exceed four billion dollars annually. Insects cancel out the produtive efforts of a million men. Plant diseases are costing this country an additional three billion dollars annually. If the waste caused by plant diseases alone could be prevented, ten per cent of our farm population could be used in other occupations.

But what about nematodes? What part do they play as inhibitors in full crop production? If insects and plant diseases rank as the farmer's two worst enemies, nematodes undoubtedly are not far behind. They are present universally. They occur in the sea, in fresh water, in the desert, atop the highest mountains, at the bottom of Death Valley, in the Arctic, and in the tropics. They occur also as endoparasites of man and animals.

As early as 1743, nematodes were observed to cause damage to wheat in England. In 1879, in the United States, the root-knot nematode was discovered to be causing damage to crops in Flordia. However, galled and knotty malformations belived to have been caused by nematodes on diseased plants had been observed as early as 1805. By 1907, the root-knot nematode had been reported from several Western States, and it is now known to be in almost every state in the country. The sugarbeet nematode was discovered causing trouble in Utah sugarbeet fields

Picture Captions

Top Right: Portable hot water bath apparatus used in treating infested nursery stock. Left, stock which has already been treated; right, on truck untreated stock; center, treating equipment.

Bottom Right: Collection of soil samples in a tobacco field which were later processed in a field laboratory to determine the presence of the tobacco cyst nematode.

Left Picture: Examination of Tobacco root system for evidence of infestation of Tobacco Cyst Nematode.

about 1895. It now occurs in most of the sugarbeet areas of the Western States, and is ranked as one of the major problems of the industry.

Despite these early danger signals, the science of nematology has been neglected greatly. This is, perhaps, partly due to the fact that it is often difficult to prove nematodes to be the cause of trouble in plants exhibiting poor growth. Their complex structure and minute size make an experimental approach difficult.

Since nematodes seldom kill the plants they attack, but deprive them of their vigor, growers are often inclined to blame poor plant growth on lack of soil fertility or on weather conditions. Losses inflicted annually by nematodes constitute a serious economic problem, both actual and potential.

While there are no reliable figures available as to the annual losses in agriculture, horticulture, and forestry due to nematodes, it is established that they range from 500 million to 1¼ billion dollars. On the other side of the ledger, we do get some beneficial assistance from nematodes through their control of noxious insects. Nematodes of the family Steinernematidae attack insects, but have no injurious effect on man, plants, or animals. These bacteria-carrying nematodes pierce the intestine of both larval and adult insects, and release disease bacteria that multiply rapidly and kill the hosts, often in less than 24 hours. The bacteria then serve as a source of food for the nematodes, permitting them to multiply more rapidly. These disease-carrying nematodes have proven deadly so far to the codling-moth, the corn earworm, the boll-weevil, pink bollworm, vegetable weevil, and a cabbage worm.

Limited field tests carried out in cooperation with Dr. W. S. Hough of the Virginia Agricultural Experiment Station indicate that 60 to 70 per cent of control of the codling-moth from apple orchards may be possible. The methods provided nearly the same degree of control in corn earworm in tests at Beltsville, Md. Dr. S. R. Dutkey and Dr. J. V. Thompson, USDA Agricultural Research Service, are investigating the broad-scale application and value of nematodes to American agriculture in controlling insect pests.

At the USDA, insect pathology laboratory (Beltsville, Md., Methods have been developed for rearing large numbers of nematodes using larvae of the wax moth as a host. Each larva can produce about 150,000 nematodes, which can be maintained in the body of the host or in jars of pure water that are refrigerated or aerated. The nematodes are then ready to be used on insect-infested plants.

So far, tests have shown that nematodes can be applied to the plants through a high pressure nozzle without too great a degree of mortality. The nematodes are also quite resistant to most insecticides in common use. Thus, nematodes and insecticides could be used simultaneously for insect control. These scientists point out however, that most research must be done before such procedures are available for practical farm use.

Control of nematodes is difficult, and their eradication presents many problems that appear almost insurmountable. Rotation of crops and prevention of spread have long been relied upon for nematode control. In many European countries, the problem is so serious that the law requires rotation of potatoes on a 4 to 8 year basis because of the damage inflicted by the golden nematode. In Sweden, Holland, and Denmark, the law requires the removal of land from host crop use for an indefinite period when the golden nematode is present in the field. The soybean cyst nematode in Japan seriously reduces yields if soybeans are grown on the land continuously without rotation. In Hawaii, where pineapples have been grown on the same land for more than 40 years, nematodes have become a serious factor in pineapple production; and in Peru where the golden nematode may be native, the Incas in the highlands of Peru learned centuries ago to rotate their native potatoes to obtain a good crop. The story is the same throughout the world where crops are grown continuously on the same land without rotation.

This country has its share of native nematodes and other plant pests that are causing serious crop losses. When our forefathers came to America it was a land free of most of the Old World's worst agricultural pests, but it did not remain that way for long. It was not until 1912 that we got around to passing the Plant Quarantine Act to stop the United States from becoming the "nursery dumping ground of the world." But by this time several pests of foreign origin had become well established.

Our total imports have tripled since 1912, but the number of harmful foreign pests introduced have been cut in half. A similar drop has been achieved in plant diseases. With modern high-speed travel, contant pressures are brought to bear on United States quarantines, both foreign and domestic. Quarantine inspectors are averaging nearly 800 interceptions every day in the year. Constant vigilance is required, particularly for the almost microscopic nematodes. Each year, about one-quarter million small packages of shamrock arrive from Ireland and the United Kingdom for St. Patrick's Day. The finding of golden nematode present in soil clinging to the shamrock roots now makes it necessary to require fumigation of all shipments to eliminate the risk of spread.

When the Mayflower II arrived at Provincetown, USDA inspectors found cysts of the golden nematode present in soil which had sifted down over cargo from bags of potatoes. Thus, it leaves one to wonder what Mayflower I and the ships that followed brought into this country.

Nematodes first came to the attention of the Department as a regulatory problem in 1919, at which time a hearing was called to determine whether quarantine action was necessary in the control of the nematode disease affecting wheat, oats, and rye in Virginia, West Virginia, and Georgia. No quarantine action was recommended, because it was considered that the disease was so slow in spreading that the problem could be handled easily by crop rotation.

It was not until 1926 that the U. S. Department of Agriculture invoked regulatory measures involving nematodes. On July 15 of that year, Domestic Quarantine No. 26 was issued to prevent the further dissemination of certain injurious pests affecting narcissus bulbs. The narcissus bulb quarantine was revoked on April 11, 1935, because it was found that the bulb nematode and the greater bulb fly had a wide range of hosts, and that these pests are distributed widely in the United States, thus making eradication apparently impractical.

With the removal of this quarantine in 1935, no further domestic quarantines were enacted against nematodes until the Federal quarantine against the soybean cyst nematode became effective July 25, 1957. This is not to say, however, that the Plant Pest Control Division has not been active in this new field. Here are some examples of work done by the Division in cooperation with the states.

Golden Nematode

The golden nematode is recognized throughout the world as one of the most difficult of all crop pests to control. Once established in a field, the golden nematode of potatoes has never been eradicated despite crop rotation and soil fumigation according to USDA Circular 875, issued in 1951.

Today, we think we see some hope of elimating the golden nematode from an infested field. Research over the past several years and experience with various types of chemicals show that 95 to 98 per cent results can be obtained with 45 gallons of D-D mixture applied to the acre. With improved application methods together with an increased amount of nematocide, a field-scale test has been made using D-D mixture applied at the rate of 90 gallons an acre in two equal treatments of 45 gallons each, ten days apart, with the soil turned between treatments. Such a test was initiated in the fall of 1955. In the spring of 1956, potatoes were planted on the test acreage and potatoes were planted again in 1957-58 crop years. Following the 1956-57 potato crops, soil samples were collected from the fields now under observation and no living golden nematodes were found. Samples will be collected and examined following the harvesting of the 1958 crop. Each year additional new fields have been added to the field-scale test. We now have one potato field of 23 acres which has grown three crops of potatoes, and three fields which have grown two crops. Another field was added to the test in 1958, so by the end of the year 1959 potatoes will be growing on five treated fields with an aggregate of about 75 acres.

Tractor applicator applying soil fumigant to an infested potato field.

Little is known of golden nematode origin. This nematode was found in an isolated potato field in Germany about 75 years ago and has since been reported from many European countries and England. The discovery of the pest on Long Island in 1941 marked the first reported occurrence of this cyst nematode on the North American continent. More recently it has been found in Mexico, Argentina, Brazil, and Peru.

Plants attacked by the golden nematode are stunted and die early with resultant reduction in size and yield. From 30 to 80 per cent reduction in potato yields has been reported in heavily-infested fields on Long Island. In England, potatoes cannot be grown profitably more than one year in five to eight where high populations of the pest are present. Quarantines and withholding of infested land from production of potatoes and tomatoes have been adopted as control measures on Long Island. Periodic surveys have been made in potato-growing districts of this country since 1944 without finding this nematode established in any other location.

Long Island is one of the most important potato-producing sections in the country. Suffolk County ranks third in importance of potato-producing counties in the United States. The early adoption of stringent regulations governing the movements of potential carriers of cysts and removal of known infested fields from host crop production is largely responsible for holding the infestation in check on Long Island, and preventing its spread throughout potato-growing districts of the country. Since the cooperative Federal-State

(Continued on Page 111)

Fertilizer-Pesticide Mixtures Down 40%

THE U. S. Department of Agriculture* last month issued a report on the consumption of commercial fertilizers containing pesticides in the United States for the year ended June 30, 1956. Consumption totaled 120,868 tons — a drop of some 79,000 tons under the previous year, when an estimated 200,000 tons of fertilizer-pesticide mixtures were applied.

Estimates for consumption of fertilizer-pesticide mixtures for the years 1950-1956 are as follows:

IN TONS

	(a) 1950	(b) 1953	(c) 1954	(d) 1955	(e) 1956
South Atlantic Region	—	60,000	73,200		47,039
West South Central	—	100	100		1,514
West North Central	—	2,000	42,600		33,475
Total	10,000	87,000	149,100	200,000	120,868

(a) Estimate by A. L. Mehring (1951).
(b)(c) Regional estimates by K. D. Jacob (1954 and 1955). Fertilizers containing pesticides were registered in 1952-1953 with control officials of 23 states and Puerto Rico; in 1953-54, 41 states registered.
(d)(e) 1955 estimate by H. H. Shepard (1956). 1956 figures in current report by USDA.

As shown in Table 2, shipments of fertilizer-pesticide products in 1955-56 totaled 120,868 tons, comprising 109,956 tons of mixed fertilizers and 10,912 tons of fertilizer materials. Consumption of the respective classes represented 0.74 per cent of all mixed fertilizers and .15 of all fertilizer materials consumed in the United States in 1955-56.

Mixed Fertilizers

IN the continental United States, 24 grades of mixed fertilizers containing pesticides were consumed in amounts of 1,000 tons or more. These totaled 69,827 tons or 65.73 per cent of the mixed fertilizer-pesticide products. Other grades numbered 134, and amounted to 22,102 tons (20.82 per cent). The balance (14,279 tons, 13.45 per cent) was not reported by grade. In addition, 24 grades (3,748 tons) were consumed in Puerto Rico. Approximately 11 per cent of the total number of grades of mixed fertilizers consumed on the continent and 60 per cent of those consumed in Puerto Rico contained pesticides.

Materials

THE use of materials as carriers of pesticides was much less than that of mixed fertilizers. It was also relatively small when compared to the total use of this class of fertilizers. The areas of consumption with pesticides were directly related to the areas of importance in their normal use as a fertilizer product.

The largest tonnage of materials containing pesticides was used in California (1,495 tons), followed by Iowa (1,299 tons), Oregon (1,198 tons), Washington (1,153 tons), and Puerto Rico (1,085 tons). The total of these accounted for 57.1 per cent of the national consumption.

Pesticides

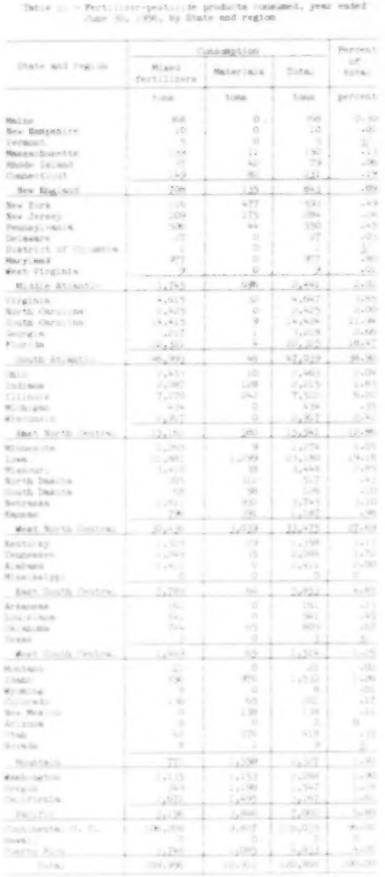
IT is estimated from the information supplied by the manufacturers that the quantity of pesticides incorporated in fertilizers in the continental United States in 1955-56 amounted to 552 tons-467 tons of aldrin, chlordane, dieldrin, heptachlor, and toxaphene; 31 tons of IPC, 24 tons of 2,4-D, 29 tons of DDT, and 1 ton of arsenical compounds. Excepting IPC, these quantities represented 1.52, 0.15, 0.08, and 0.01 per cent of the respective total disappearances of these pesticides in this period. Information on the total disappearance of IPC was not available.

More than 57 per cent (63,595 tons) of the mixed fertilizer products, and 58 per cent (6,393 tons) of the material products contained aldrin. Most concentrations came within the range of 8 to 12 pounds per ton of fertilizer.

Chlordane was used in 32 per cent (35,859 tons) of the mixed fertilizer products, and 13 per cent (1,396 tons) of the material products. Most products contained 2 to 10 pounds of pesticide per ton of fertilizer. Products containing chlordane were marketed in greater volume than those containing aldrin in most of the New England, Middle Atlantic, and South Atlantic States.

Heptachlor was incorporated in 5 per cent (5,984 tons) of mixed fertilizer products and 4 per cent (436 tons) of the material products at concentrations of 4 to 10 pounds per tons. Fertilizers containing this

(*Continued on Page* 106)



*Report prepared by Walter Scholl, Hilda M. Wallace and Florence B. Crammate, of the Fertilizer Investigations Research Branch; Soil and Water Conservation Research Division; Agricultural Research Service, USDA, Beltsville, Md.

"SOIL PRODUCED"

Superphosphates

by Alva A. Preston, Jr.
Extension Specialist
Agricultural Extension Service
Columbia, Missouri

"SOIL Produced" superphosphate has given wheat yields comparable to those from conventional TSP, in two years of tests at the Missouri College of Agriculture. The "soil produced" material was made by applying rock phosphate to the soil in bands, then adding either sulfuric or phosphoric acid directly to the band of rock.

While experimental results were good, the "soil produced" material has practical limitations. However, the work suggests that "field produced superphosphate might have possibilities. By "field produced" we mean mixing the acid and rock as it is spread, rather than spreading rock and then attempting to add acid as was done in this experiment.

This idea brings up some interesting questions. First of all, could bulk fertilizer spreading trucks, which are becoming common in some sections, also be made to serve as satisfactory field acidulators? Second, could spent sulfuric units for regular acidulation be utilized? Third, could phosphoric storage being developed at county points in connection with liquid fertilizer plants be further utilized in such a program? How about weak wet process acid?

The experiments were carried out on a low phosphate, Putnam soil, at the McCredie Experimental Field. Briefly, the plots were arranged so that one plot had nc phosphate. Another had 1,000# of rock per acre. A third had 1,000# of rock, plus enough regular TSP to provide 60# available P_2O_5 per acre. A fourth plot had 1,000# of rock, with enough phosphoric acid added to the rock, after rock was applied, to theoretically convert 60# of available P_2O_5 from the rock. The fifth plot had 1,000# of rock plus sulfuric acid to convert 60# P_2O_5.

Small furrows were opened in the seedbed. Rock was applied in a narrow band in the furrow bottom. TSP and acids were added directly to the band of rock. A thin layer of soil was pulled over the treatment. Wheat was drilled the following day in the rock acid mixture. Plots were 1/2000 of an acre, replicated 5 times. 100# of N and 120# K_2O were top dressed on the plots in the spring. Yields were:

Wheat Yields Bushels/Acre

	1957	1958
No Treatment	24	*
Rock Phosphate Alone	36	38
Rock Phosphate/ TSP	57	57
Rock Phosphate/ Phosphoric Acid	60	62
Rock Phosphate/ Sulfuric Acid	52	63

*Lodging prevented harvesting.

It is impossible to reach definite conclusions from two years results on plots of this size. However, the yields suggest that both sulfuric and phosphoric acids gave results comparable to the regular TSP. From field observations at the time treatment was made, it was apparent that both normal super and TSP were being produced.

The first year there was some doubt as to whether enough contact was being made by the sulfuric acid to give complete conversion. A wetting agent was added to the acid the second year. It appeared to give a much better reaction, and may explain the variation in yield on the sulfuric plot.

The practical limitation of the above work is obvious. Too much hand labor is involved. In an effort to avoid this, a grain drill equipped with a stainless steel tank and a hose pump was rigged up. Rock phosphate was put through the fertilizer attachment, and phosphoric and sulfuric acid directed from hoses onto the band of rock.

This machine failed to work. The normal motion of the drill on the seedbed, plus gusts of wind, made it impossible to adjust the acid hoses, so the acid would fall on the band of rock. As a result this effort was abandoned. However, one thing became obvious. When the acid did hit the band of rock it made normal super or TSP depending on the acid being used.

This automatically brought up the idea of mixing the acid and rock as the rock is spread. After all,

(*Continued on Page* 114)

COTTON PRODUCTION CONFERENCE

features report on new pest control methods

TEN new approaches to controlling the boll weevil and other insects were described at the Beltwide Cotton Production Conference, held December 17-19 at the Rice Hotel, Houston, Tex. T. B. Davich, entomologist with the USDA at the Texas Agricultural Experiment Station, College Station, outlined the following avenues to insect control developed by many investigators:

1. Diapause – This approach offers more immediate promise than any of the others. Diapause refers to the state of arrested growth or reproduction that is typical of hibernating insects. Evidence indicates it takes the boll weevil three weeks or more to accumulate the fat reserves required for successfully entering diapause and surviving hibernation. An intensive research program is in progress to exploit this "weak link". Leads include continuation of an effective chemical control program until the first frost or until the stalks are destroyed.

2. Sterile Male Technique – The success of the screw-worm eradication program, in which males were made sterile by gamma irradiation, has drawn the interest of cotton entomologists. Preliminary data indicate a radiation dose of 10,000 roentgens will result in a "transient" sterility in male boll weevils. In a single test, infertile eggs were laid for two and one-half weeks. After this period, 13 per cent of the eggs hatched normally.

3. Systemic – Use of systemic insecticides has proved effective in controlling early season insects. Now a way is being sought to get the insecticide into the cotton square in sufficient amounts to kill the larvae of overwintered boll weevils.

Summarizing insect control recommendation changes agreed upon by the Cotton Insect Research and Control Conference, Dr. M. E. Merkl, Delta Branch Experiment Station advised that there were very few changes for 1959.

The only insecticide added to the recommendations is Sevin for control of boll weevil, bollworm and pink bollworm. For aphid control, miticides trithion and ethion are being recommended across the belt. In some states, Toxaphene-DDT (2 to 1) is being added to the recommendations for the control of boll weevil.

Also across the Cotton Belt, BHC is being dropped from the recommendations for aphid control; and in certain states, Guthion is being deleted for cotton aphid control.

4. Plant Resistance: Genetic– Scientists are searching for ways in which the cotton plant can be made more resistant to the boll weevil. Factors in this approach include boll wall thickness, toughness of the carpel lining, plant color, hairy stems and leaves, and the ability of plant cells to grow and crush the boll weevil egg or developing larva.

5. Plant Resistance: Chemical – This approach is based on two premises. The first one involves the absorption by the plant of a chemical or chemicals that are effective at the desired site of action, such as a boll. The second premise is that the compounds could have an adverse effect on the biology of the insect, such as inhibiting egg hatch, preventing pupal development, and excessively prolonging adult emergence.

6. Attractancy-Repellency – Although successful with certain insects, this approach has not been investigated sufficiently with the boll weevil. A few naturally occurring materials and chemical compounds have been found to possess a moderate degree of attractiveness under laboratory conditions, but field tests resulted in failure. The aim of a project now under way is to identify the substance or substances which attract the boll weevil to the cotton plant.

7. Infested Square Destruction – The vast majority of weevil-infested squares drop from the plant, and population buildups result primarily from adult emergence from these squares. If a way could be found to destroy these squares, or to kill the weevils developing in them, a damaging infestation would not occur, theoretically, until well past the time ordinarily needed for chemical control measures.

8. New Insecticides and Formulations – Mr. Davich said that to his knowledge, no chemical laboratory has pinpointed the boll weevil as the primary insect in a program of synthesizing new compounds, or devising more effective formulations. Development in the near future of an economical method for rearing the boll weevil should help make possible a new compound synthesis and formulation approach devoted primarily to this insect.

9. Hormones and Antimetabolites – The "juvenile hormone," since it inhibits molting and, con-

(*Continued on Page* 107)

MICROBIAL CONTROL of *Insects*

*by Irvin N. Hall**

Laboratory of Insect Pathology
Department of Biological Control
University of California, Riverside

INSECTS are known to be subject to attack by representatives of practically all of the groups of microorganisms including the rickettsia, fungi, protozoa, viruses, bacteria, and nematodes. The entomogenous members of practically all of these groups have been studied to some extent for their potential as microbial control agents. However, during the past few years most of the advances have been with the use of the viruses and bacteria.

The highly pathogenic organisms that may be considered for use in the microbial control of insects in general fall into two categories. The first category includes those organisms that are better suited to limited introductions or colonizations since they have effective methods of dispersal and development, permitting spread and survival despite fluctuations in the host population. Examples of this type in our own area are the entomophthoraceous fungi that attack the spotted alfalfa aphid. The commercially produced milky disease bacteria that are used as an aid in the control of the Japanese beetle can also be included in the group, since only single inoculations are required for establishment of the organisms.

The second category includes those organisms that are suited for direct application on plants for the initiation of epizootics to bring about microbial control of a given pest population. It is with the organisms in this latter category that the agricultural chemicals industry should be interested, and the remainder of this discussion will deal mainly with these so-called "microbial insecticides."

There are a number of prominent aspects that have a direct bearing on the acceptability and commercial use of insect pathogens. The principal advantages of using entomogenous organisms are:

1. The harmless and nontoxic nature of insect pathogens for other forms of life; hence, the absence of toxic residues.

2. The relatively high degree of specificity of most pathogens, which tends to protect beneficial insects.

3. The compatibility of many pathogens with many insecticides, permitting living and chemical materials to be used concurrently.

4. The ease and inexpensiveness with which some pathogens can be produced.

5. The pathogens may be used as sprays or dusts in the same fashion as chemical insecticides.

6. The apparent slowness with which a susceptible host develops resistance to a microbial pathogen. As yet there is no authenticated instance of an insect's acquiring a resistance to an introduced pathogen or one directly applied in the field.

7. The low dosages required to kill highly susceptible insects.

We also recognize a number of disadvantages to the use of microorganisms. They are as follows:

1. The necessity for careful and correct timing of the application of the pathogen with respect to the incubation period of the disease. As living agents, microorganisms often act more slowly than do chemical insecticides; therefore they must be applied early enough to ensure that the crop will not be damaged before the insects die.

2. The relatively marked specificity of most pathogens can limit the spectrum of effectiveness of an organism to only one insect species where several pests are involved, all of which may be controlled by a single chemical insecticide.

(*Continued on Page* 112)

*Before Western Agricultural Chemicals Assn., San Mateo, Calif., November, 1958.

FIRE ANT CONTROL

THE CASE AGAINST--

THE National Audubon Society has just released a severe indictment of USDA's fire ant control program. They find fault with the insecticides employed, the preparation which preceded initiation of the program, the methods of application and, in fact, the actual need for any attempt to control the fire ant. They charge that the fire ant control program resulted in an alarming kill of many species of wildlife and livestock, and potential damage to soil organisms and humans. Charging that the program was launched without adequate information, they recommend immediate steps to authorize an adequate research program to determine both immediate and long term effects of such insecticide applications on wildlife, soil organisms, livestock and people.

To justify such a program involving the broadcasting of toxic chemicals and the expenditure of public funds, says the society, "there should be convincing evidence of the need for control; a fund of basic data about the target insect upon which to base control measures; proof that the measures selected for control will be effective and will not have seriously adverse side effects on forms of life other than the target insect." They cite evidence to suport the view that the imported fire ant "does not do serious damage to crops, livestock, people or wildlife." Reports of such damage, they say, are erroneous.

Two investigators for the Alabama Conservation Department are quoted as saying: "The writers could find no evidence that the fire ant preys upon either cultivated or wild plants." They also quote the Department to the effect that "after thorough checks these losses (crop damage) could not be substantiated." Quoting Mississippi State University on the eating habits of the fire ant, they report: "Many times the ants were found in cotton fields taking boll weevil larvae from cotton squares. This suggests that the imported fire ant may well be a beneficial insect in many respects." Their inquiry, they say, "disclosed no proof whatsoever of injury to livestock by the ant." An Alabama doctor, Dr. Maurice Baker, is reported to have declared that "there is not one authentic case of fire ants killing calves, lambs or other livestock in Alabama." Concerning possible hazard to humans, they quote Dr. F. L. Arant of Alabama Polytechnic Institute: "The ants constitute a minor hazard to children on lawns and playgrounds, but will not attack unless the mounds are disturbed." Dr. Arant adds, however, that the fire ant attacks workmen in infested areas. "The sting of the ant is such that hand labor will not work among the insects."

Specific criticism is made of the toxicity hazard of the pesticides employed, dieldrin and heptachlor. In comparative feeding experiments with penned quail and pheasants, they say, heptachlor proved to be 10-15 times more toxic than DDT, and dieldrin 20 times more toxic. They suggest that more should have been done to investigate the possibilities of use of baits and attractants. Since the fire ant is less susceptible to poisons than other insects, the investigation of baits and attractants, they believe, should have been a primary research goal. No efforts were made, according to the Audubon Society representatives, to determine the relative effectiveness and cost of lower rates of application of various pesticides, nor was any attempt made to discover more selective toxicants.

As a result of the program, the society charges, "almost all wildlife species in the treated areas—including birds, mammals, fish, reptiles, amphibians, insects and crustaceans—were killed." They admit that there was very little evidence reported of such widespread destruction, but charge that this resulted from unfamiliarity of farmers and inexperienced person with the habits of wildlife. Reports from the field at the time of the actual spraying indicated that while there was some temporary reduction in bird populations, the balance was restored rather rapidly within a few weeks after spraying terminated.

Heavy losses of aquatic life resulted, the Society report charges, and they also state that "earthworms were reduced in treated plots in Louisiana by 78.9%. Charging kill of livestock, they cite the experience of a Dr. Poitevant in the area around Climax, Ga., who reports that more than 100

(*Continued on Page* 107)

PROGRAM

THE affirmative case for the Fire Ant control program is presented in a recent statement by W. E. Blasingame, director of the Georgia Department of Entomology, Atlanta. He points out that "the basic philosophy of the imported fire ant eradication program is that it is much better to live without an insect pest than it is to live with it, and that the eradication of this insect, while the area of infestation is relatively small, is sound, thereby removing the necessity of the people, primarily farmers, from having to fight this insect for the rest of time and bearing the financial strain caused by control and crop damage." The boll weevil, he reminded, a pest introduced into the U. S. back in 1892 from Mexico, has cost the country eight billion dollars since that time in losses to the cotton crop.

When the fire ant eradication program was initiated in 1957, in Arkansas, says Mr. Blasingame, the importance of area treatments soon became apparent. "In Union County, Arkansas, where imported fire ants were first found in 1950, and where individuals have been continuously applying controls to individual mounds, it was found that such treatments were causing the ants to abandon the treated mounds, thereby materially increasing the size of the infested area."

Concerning the particular pesticides employed and the methods of application, Mr. Blasingame asserted that the relative toxicity of the pesticide employed is not necessarily the important factor, but rather the treatment techniques, the procedures followed and the safeguards employed. "How these insecticides will be used in carrying out this program is the key question, and years of research and use experience by state, federal and private agencies have proven that heptachlor and dieldrin can be used safely." He noted that "a survey of virtually every impoundment of water over a 48,000 acre treated area by a team of biologists from the U. S. Fish and Wildlife Service failed to find a single dead fish." He called attention to the granular form of the pesticides employed in the program, reminding that "granules have the desirable characteristic of adhering very little to foliage of trees, shrubs and underbrush as do sprays and dusts. Because of this, other insect life, birds and other animal forms feeding on foliage would not be affected."

As to possible adverse effects of the program on wildlife, he said "Experience gained from the white-fringed beetle program where granular dieldrin has been used for the past six years at even higher dosages than are required for fire ants, has shown that such treatments can be made without significantly affecting wildlife. Many feel that this program will actually benefit certain forms of wildlife."

Turning to the criticism that has been leveled at the program, he observed that "Certain special interest groups have demanded that treatments cease, pointing out that complete information is not available on the biology of the ant, long term effects of insecticides being used and their effects on all animal life, and that perhaps better methods of control could be devised." He points out in rebuttal, however, that the fire ant is spreading at an alarming rate and that delay in initiating a control program could be very dangerous. "Refinements of procedures being used, which are based on specific research on imported fire ants begun as early as 1949, would have to be phenomenal to compensate for the additional acreage that would be infested."

He called attention to a report prepared in July, 1949, by E. O. Wilson and J. H. Eads of the Alabama Conservation Department, in which they stated that evidence was found of the ant badly damaging corn, potatoes, soybeans, sweetpotatoes and cabbage; destroying bee colonies, disfiguring lawns and stunting garden plants; entering houses, raiding food and stinging when disturbed; and attacking game and songbirds. Based on the damage, to crops observed in this study, he said that "if fire ants were allowed to infest all of the acreage planted in Georgia to corn, cotton and sweetpotatoes, the monetary loss to these crops alone would be in excess of ten million dollars."

Insects, Mr. Blasingame, reminded, cost the country annually about four billion dollars. "Fire ants, by attacking all succulent plant growth, seeds, by preventing or impeding the harvesting of crops, by damaging farm machinery, by killing newborn livestock would add materially to this tax. . . . The fire ant, which has the capacity for taking human life or causing serious illness from the effects of multiple stings, could add its toll to those insects affecting human health.

"In two years, Georgia will, from a practical standpoint, be free of imported fire ants. Georgia farmers will not be required to spend hard earned money to purchase insecticides to control fire ants from

(Continued on Page 107)

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The AGRICULTURAL Applicator

THIS MONTH'S FEATURES

- NATA Meeting Report—Part 2
- Applicator Accident Study
- Bulk Fertilizer Program
- An Applicator Reports on Use of Sevin on Cotton
- Outlook for Pest Outbreaks

Applicator Accidents Report Shows Decline In Fatalities

THE Bureau of Safety of the Civil Aeronautics Board has issued a report dealing with aircraft accidents that occurred in aerial application activities during 1957.

In 1957 there were 370 aircraft accidents reported in activities such as seeding, dusting, and spraying. According to Civil Aeronautics Administration reports, 5,100 aircraft and 4,100 pilots (including those on a part-time basis) flew a total of 865,800 hours in aerial application activities in the continental United States.

Of the 370 accidents, 43 resulted in fatalities. Forty-four persons were killed and 46 were seriously injured. The number of aircraft destroyed was 132 and 218 aircraft were damaged substantially. The accident rate per 10,000 hours flown was 4.27, an increase from the 3.45 rate shown for 1956. The fatal accident rate, however, continued to decline in 1957 with a .50 rate for 10,000 hours, compared to 1956's .56 and a high of .80 in 1954.

The most common type of accident in 1957 was collision with objects, with a total of 166. Sixteen of these were fatal. Collision with wires, poles, trees, and fences accounted for 123 accidents. Additionally, two persons and five vehicles were struck. Also in this category were 33 collisions with miscellaneous objects such as ditches, stumps, and earth mounds, most of which were encountered during takeoff or landing.

Although not included under the type heading of "Collision-Objects," there were an additional 14 accidents listed as "Snagged Crop" which are closely related to this type of occurrence.

Stall accidents ranked second in frequency of occurrence with 97 (25 per cent of total), 18 of which were fatal. There were two fatal accidents caused by persons walking into a revolving propeller.

Powerplant failure or loss of engine power for any reason, such as fuel exhaustion, failure to switch to other fuel tank, and failure to use carburetor heat, is not classified as an accident type in the report. Accidents resulting from such conditions are typed in accordance with the final event in the accident, such as collision with ground or tree or as a stall accident. In this category there were 74 accidents, (20 per cent of the total), in which engine stoppage or power loss occurred for various reasons.

In addition to the type categories, accidents are classified according to the flight phase in which the aircraft was operating at the time of the accident. Except in the case of emergency conditions, such as power failure, the operational phase is considered to be that in which the aircraft was operating at the time of the emergency. 240 accidents occurred in the in-flight phase, 68 on takeoff, and 54 accidents occurred during landings. Five accidents occurred while the plane was on the ground and were caused by the aircraft getting away with engine running when no one was in the cockpit. In one case, an aircraft ran into another parked aircraft.

Stall accidents accounted for 97 of the 370 accidents. Eighteen of these accidents were fatal and 16 resulted in serious injury. Of 69 stall accidents during the in-flight phase, 39 occurred during the procedure turnaround, seven occurred in the pull-up from swath run, seven in the swath run, four surveying field, and nine en route to or from application process.

In 11 cases, the stall was associated with loss of engine power due to fuel exhaustion, fuel contamination, misuse of engine controls, or mechanical failure. In five cases, the aircraft was overloaded for the existing conditions. In respect to gross weight, 19 of the aircraft involved in stall accidents were operating over the design gross weight. Of these 19 cases, two of the aircraft were reported to be under Part 8 approved weight. There was no case reported wherein the aircraft exceeded Part 8 approved weight. In one case, a fatal accident, the pilot was performing acrobatics after completion of dusting work.

Emergency landings were involved in 80 of the 370 accidents. More than half of these (46) were made necessary by engine failure or malfunction. Twenty-two were caused by fuel exhaustion or contamination.

There were nine cases in which the pilot was affected by the chemicals being used. In five accidents, the pilot was affected in flight. In one of these, a fatal accident, the pilot had not used proper protective equipment. In four cases the pilot was affected on the ground in the accident sequence by chemicals which were released as a result of the crash. Antidotes were available in only five of these nine occurrences.

Shoulder harnesses were used by pilots in 250 accidents. In 24 cases they were available but not used. In one case where it was reported that the available shoulder harness would have been effective if used, the shoulder harness was not used and the pilot was killed. In 15 instances of shoulder harness failure, seven were fatal accidents and five resulted in serious injury. It was not possible, however, to infer positively that the failure was solely responsible for the injuries received.

(*Continued on Page* 111)

Dry Fertilizer Marketing Program Features Complete Bulk Movement

A NEW marketing program for dry fertilizers, developed by a distributor on the West Coast last summer, features bulk movement of materials from the producer to the farmers' fields. Wilson & Geo. Meyer & Co., Los Angeles, is offering the "custom service" program to dealers in its area, which eventually will include every state west of the Mississippi except Louisiana and Texas.

The basis of the program is a line of specially-designed equipment for unloading, conveying, storing, and applying bulk materials. According to a survey prepared for dealers by field men of Wilson & Geo. Meyer, a big expansion can be anticipated in the custom application of dry fertilizers. Because custom application offers the farmer substantial savings in time and labor, reduces his equipment investment, and makes it possible for him to get more acreage fertilized properly during the busy application season, more and more farmers are using the services of custom applicators.

Wilson & Geo. Meyer have prepared a program to demonstrate to dealers the means for handling their fertilizers in bulk. Among the special equipment units in the Meyer Co. program is a mobile rail-car unloader. This is a shallow steel hopper with a power-shovel winch mounted on top. A standard belt conveyor, powered by a gasoline engine, is mounted on a wheeled carriage and moves material from the unloader hopper.

A portable horizontal storage tank of 25 tons capacity is made up of two hoppered compartments and is mounted on a pair of airplane wheels. The dealer can unload directly into this storage tank, or into a spreader truck. The Wilson & Geo. Meyer program utilizes a spreader that is a standard hopper body with a spinner type spreader mounted on a government-surplus 3-axle truck.

Also included as part of the program are a number of hoppered bulk boxes on legs and a small self-powered conveyor. Each box holds about 3,000 pounds of fertilizer, and four of them will fit comfortably on a flat bed truck. These units are designed to help farmers convert to bulk handling in their own spreading operations. The grower drives his own flat bed truck to the dealer's warehouse where bulk bins and a conveyor are set on with a fork truck. The farmer then can drive directly to the field and load his spreading equipment from the conveyor.

Although not the first attempt at bulk movement of dry fertilizers, this new program is certainly the largest. Wilson & Geo. Meyer feel that bulk handling will make dry materials more effectively competitive with the convenience features of bulk-liquid distribution.

The Wilson & Geo. Meyer program is being carried out with the assistance of the Stauffer Chemical

(*Continued on Page* 109)

Applicator Tells Results of Tests With Sevin on Louisiana Cotton

by Bob Graves

Graves Flying Service
Tallulah, La.

LAST year, the Graves Flying Service was asked by the Federal Agricultural Experiment Station, The Union Carbide Chemicals Co., N. Y., and the Cotton States Chemical Co. to help out with the field testing of Sevin, a new type insecticide. Sevin is a carbamate and is completely different in chemical structure from the chlorinated hydrocarbons and the phosphates.

Our job was to apply Sevin on the farms of cotton growers and the expectation was that the results of this testing and other widespread field trials would lead to regular commercial marketing of Sevin in 1959.

In our tests, Sevin looked good as a boll weevil control and also was effective against bollworms, which really were more of a problem last year than boll weevils in Louisiana. Another thing we have noticed about this material that will be of special interest to airplane applicators, is that the Sevin dust was free-flowing and went on well. It was as good a dust as we ever have applied. We were told that tests show Sevin to be safer

Bob Graves

than many other insecticides and this was borne out in actual experience. Usually, we can tell when we fly through a dust whether or not it is going to be very safe. Dusts that are pretty toxic sort of "burn you out." They burn your skin and you hate to breathe. This did not seem to be the case with Sevin dust.

Altogether, we dusted more than 300 acres four times with Sevin at six to seven day intervals for mid- and late-season insect control. On one large plantation, we found that weevils were not bad throughout, but some weevil "hot spots" were developing. After we started applying

(*Continued on Page* 110)

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Aerial Applicators

N.A.T.A. Discusses Insurance And Efficient Pest Control and Operation

Conclusion of a two-part Agricultural Chemicals report on the meeting of the National Aviation Trades Association, Nov. 11-14. The first portion started on page 48 in December.

E. D. Burgess, director Plant Pest Control Division, ARS, USDA, discussed the role of the aerial applicator in plant pest control. He reviewed the major pest control projects, including the gypsy moth spray program, the grasshopper program, the fire ant program, and the Medfly eradication program, recalling that these programs have been the target of considerable criticism from conservationists, organic gardeners, bird lovers, etc. He warned his listeners that in addition to the criticism of these publicly sponsored and financed programs, public opinion in many quarters "is swinging toward an insistence that pest control, either by public agencies or by the farmers themselves, be accomplished by means other than those currently in use."

He noted that there is a tremendous interest in biological methods of control and the development of new pesticides which will leave no residues. Research workers are also being urged to explore chemicals which will give specific control of particular pests. These proposals, he recognized, constitute a large order, "and there is nothing new on the immediate horizon that we know of that will satisfy any of these demands and at the same time get the job done."

Dr. Burgess reviewed a series of comments by various critics of aerial spraying, which express the opinion that aerial application of pesticides "may be the least desirable of the many methods of pesticide application." It is recognized that in some situations weather conditions, pilot error or other factors may not permit uniform distribution. He expressed his confidence, however, that under satisfactory operating conditions "dispersal by aircraft *can* be accurate and uniform, and in those cases where the use of aircraft is indicated pesticides can be distributed more effectively by this than by other means."

There seems to be little excuse, he observed, "for pilots getting lost and either treating areas not scheduled or contributing to multiple applications. The problem of retreating or skipping spots when returning from the airstrip to pick up where work previously left off appears more difficult of solution. There is no excuse, however, for short cutting good operating procedures to make up for lost time or to recoup a profit on a job that may have been bid in at too low a figure."

So far as the aerial operations chartered by the Plant Pest Control Division are concerned, Dr. Burgess emphasized that they can accept nothing less than top quality work. "When we advertise 'eradication' and the job requires uniform chemical coverage, it is imperative that each acre treated receive the same amount of pesticide as the previous one. We must keep dosage rates at a minimum because of cost and other factors. We cannot expect nor can we assure success if some areas are skipped in favor of others, and at the same time we cannot condone multiple treatments. In the former, we deliver control and not eradication, and often not either; in the latter, difficulties are bound to arise because of excess residues, damage to wildlife, or for other reasons. Any substantial increase in public opposition to our approach to the problems confronting us may have the effect of putting our operations back on the ground, thus depriving aerial applicators of further demonstrating the effectiveness of aircraft in our work."

Analysis of Operations

M. L. Janssen, agricultural economist with the Farm Economics Research Division, ARS, USDA, offered suggestions for the aerial operator interested in making a self analysis of his operations. The typical operator, he observed, must be a combination worker, manager, business man and capitalist, capable of making decisions and evaluating risks. He must be thoroughly familiar with cost-benefit ratios for various types of applications. Costs per acre are of course more important for the aerial applicator than costs per hour. His fixed costs are relatively high and must be spread over as many acres as possible.

Pictured at the Milwaukee meeting are (left to right) G. D. Dunlap, Weems System of Navigation; W. T. Piper Aircraft Corp., Lock Haven, Pa.; and Edwin Lyons, Zahns Airport, Amityville, L. I., N. Y.

At left is Harry Field, United-Heckathorn, Richmond, Calif. With him is G. F. Jacobson of Northwest Underwriters. The NATA meeting was held at the Pfister Hotel in Milwaukee.

Costs of Operation of 150 hp Plane per Acre.

Item	Cents per Acre
Fuel and Oil	5.2
Pilot	7.5
Ground Crew	5.0
Liability Insurance	.4
Maintenance, repairs damage	6.0
Total Variable Costs per Acre	24.1
Fixed Cost per Acre, 26,000 acres	12.2
Total Costs per Acre, 26,000 acres	36.3
Fixed Cost per Acre, 13,000 acres	18.5
Total costs per acre, 13,000 acres	42.6

Several suggestions were advanced by the speaker on how to build business. A wider use of test demonstrations was suggested. Also more effort must be exerted to build off-season work. The aerial applicator was urged to look for jobs with large volume based on a new technology. It is often possible to take parts of a big job for several years. Summarizing, Mr. Janssen counseled:

a. Be prepared to stay in business. Keep capital funds intact.

b. Study records to find where business is profitable—how to increase volume.

c. Be prepared to sell farmers better profits—know what can be expected from application. This will help increase volume and bring better rewards.

The accompanying tables were presented, giving estimated hourly costs of operations of planes and comparative charges for application by air and ground.

Table 2. Comparative Charges for Application by Air and Ground for Various Operations Without Materials, Oregon, 1956.

Operation	Air Application	Ground Application
	dollars	
Dusting	2.26	3.02
Spraying	1.33	1.99
Fertilizing	1.46	2.43

Source: Oregon Agr. Exp. Sta. Bul. 566, January, 1958.

F. A. Gaylord, Administrator of the Insurance Trust Fund of the Agricultural Aircraft Association, Inc., said that the California aerial applicating group had helped current members and helped build new memberships by offering the advantage of group life and hospitalization insurance, because single plane operators don't come under workmen's compensation laws. He said the question has come up on group policies as far as NATA is concerned and he predicted that the lower insurance rates would make possible at least a 50 per cent membership rise if NATA had the same type program.

In the applicator regulation session, Jay A. McCausland, agricultural-industrial specialist of the General Operations Branch of the CAA discussed new regulative proposals and considerations affecting aerial applicators.

Mr. McCausland said that there is always some element of risk involved in the high speed maneuvering of any vehicle and the CAA's problem is to continuously define the very fine line between an acceptable and an unacceptable risk factor.

The CAA, Mr. McCausland said, has been waiving minimum altitude regulations to permit aerial spraying over congested areas, bringing about the need for improvement of basic airworthiness requirements.

In the last few years, he reminded, the industry has shown remarkable progress in the graduation from small, simple, single-engine aircraft to complex, multi-engine aircraft up to as high as 20,000 pounds gross weight. Original airworthiness standards can hardly be realistically applied to these bigger and more complex aircraft, he said. In addition, he continued, the original regulations contemplated operations only in sparsely populated areas, but during the last few years large acreages of congested areas have been sprayed and this trend will continue.

Regulations are being revised to insure stay-up ability of aircraft operating over towns and cities, he said. Speed rules, also, must be readjusted to include the maximum maneuvering (rough air) speed, the never exceed speed, and the maximum structural cruising speed. Mr. McCausland pointed out that these speeds are included for the purpose of giving the pilot limits within which to operate so that he may properly and adequately protect the public and himself.★★

Table 1. Estimated Hourly Cost of 150 hp Two-Place Plane for Spraying and Dusting, Including Ground Equipment.

	Total Cost		Cost per Hour	
	200 Hrs.	400 Hrs.	200 Hrs.	400 Hrs.
			dollars	
Costs Largely Fixed:				
Depreciation	1,672	2,430	8.36	6.07
Taxes	204	204	1.02	.51
Interest	408	408	2.04	1.02
Hangar	120	120	.60	.30
Total Fixed Costs	2,404	3,162	12.02	7.90
Variable Costs				
Fuel and Oil			3.75	3.75
Pilot			5.00	5.00
Regular Maintenance, Damage			4.15	4.15
Liability Insurance			.46	.29
Ground Crew			3.50	3.00
Total Variable Costs			16.86	16.19
Total Costs			28.88	21.09

PEST ROUNDUP

By Kelvin Dorward

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head — Plant Pest Survey Section, Plant Pest Control Branch, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the U. S.

Cereal and Forage Insect Activity Late in 1958

THE spotted alfalfa aphid which has been of little concern during the greater part of the year increased materially in several areas during November. Populations were so heavy in one Franklin county, Virginia, seedling alfalfa field, that the field was abandoned to be re-seeded in 1959. Two other fields in the same county were reported with heavy infestations. Counts in some young alfalfa fields of central and north central Oklahoma average 250 per sweep. Controls were applied to many young alfalfa fields, but counts were low in older fields of the same area. Following an extremely dry fall in Kansas, counts during November were the highest recorded for the year. In the eastern third of the state, counts ranged from 100 to more than 6000 per 5-plant samples. Hunt county, Texas, had populations which ranged from medium to heavy.

The spotted alfalfa aphid was collected in Union county, Illinois, but counts were not made. In Cache and Box Elder counties, Utah, populations were light, but were heavier in southern counties. During November, additional light infestations were discovered at Rogersburg, Asatin county, Washington. The aphid was found in Washington for the first time in 1958, and is now known to be in 5 counties of the state.

Although greenbug populations remain relatively light, sufficient numbers are present to be of concern next spring, providing conditions are favorable for development. The insect was easily found in 19 panhandle counties of Texas, with colonies being found in the larger wheat clumps. All stages of the aphid were found in full-seeded grain fields of 15 counties of the northeastern area of Oklahoma. Populations averaging 50-75 per linear foot were recorded in some localities, with even higher counts in clumps of volunteer plants. In Maryland, the greenbug damaged young orchard grass seedlings at Clarksville, Howard county.

The southwestern corn borer has been found for the first time in Mississippi county, Arkansas. This insect, which was found for the first time in the state in 1950 in Sebastin and Franklin counties, is now known to be in all counties. The spread has been most rapid in the main corn producing areas.

Bollworm East of Quarantine

THE pink bollworm of cotton, which was found earlier this year in Maricopa county, Arizona, for the first time since 1947, has now been found in new areas of Arkansas and Louisiana. Within recent weeks, specimens of this serious cotton pest have been taken for the first time in Ashley, Clay, Drew, Faulkner, Mississippi and White counties, Arkansas. These counties are all east or northeast of the presently established quarantine line. Within the regulated area of Arkansas, larvae have been collected in Little River, Howard, Hempstead, Miller, Lafayette, Columbia, Clark and Crawford counties. Specimens have been taken in four Louisiana parishes outside the regulated area. Collections have been made in Union and Lincoln Parishes which had been, at one time, previously infested and in Rapids and Grant Parishes, infested for the first time.

Inspections of gin trash, lint cleaners and gin stands showed pink bollworm infestations in 18 Oklahoma counties. The Oklahoma infestations in 1958 were heavier than in any previous year. Gin trash inspection consisting of 591 bushels in 26 central and eastern Texas counties resulted in the finding of 83,844 larvae, or an average of 141.75 per bushel, compared with 16.49, or eight and one-half times the number found per bushel in 1957.

In early November, the pink bollworms were heavy in green bolls on about 300 acres, and moderately heavy on 700 acres in southern Dona Ana county, New Mexico. Cotton gin lint cleaner inspections of 54 gins in 5 counties revealed 336 pink bollworms from a total of 30,546 ginned bales.

Truck Crop Insects Light

ALTHOUGH truck crop insects were relatively light throughout the country during November, a few pests caused concern. Aphids were severe on spinach in the Arkansas River Valley of Oklahoma between Haskell and Seyuolah counties. The insects were also heavy on garden turnips in Payne, Logan, Lincoln and Osage counties, and were killing turnips in

Marshall county. Aphids were also heavy on various vegetables in Lee, Baldwin and Escambia counties, Alabama.

The potato leafhopper was heavy on string beans in the Spring Valley area of San Diego County, California. In the El Centro area of Imperial county cabbage loopers were severe in lettuce plantings. The looper was again building up in lettuce fields of Eddy county, New Mexico, and damage as high as 30 per cent in some Dona Ana county fields was reported.

Peppers in the Painter, Virginia, area maturing before October 7 were damaged an estimated 25 per cent by the European corn borer. Similar infestations were reported from other locations on the Eastern Shore of Virginia. Generally, the infestation in 1958 was one of the highest on record for the Eastern Shore. The European corn borer did more damage to sweet corn in this area than the corn earworm.

Miscellaneous Insect Condition

AN egg mass survey indicates a possible increase for 1959 in the area of heavy defoliation by the forest tent caterpillar in St. Louis county, Minnesota, the area north of Duluth. Counts averaged 10.5 egg masses per tree in 21 plots over the entire area, with as high as 28 egg masses per tree in some plots. Complete defoliation can be expected with 10 egg masses per tree.

Screw-worms in cattle, sheep and hogs were reported from the Ione area of Amador county, California. These insects became more active in Custer county, Oklahoma, during late November and cases were reported from Louisiana and Mississippi in late October.★★

Meetings of Interest to Agricultural Applicators

- Jan. 22-24 — 9th annual convention, Agricultural Aircraft Assn., Senator Hotel, Sacramento, Calif.
- Jan. 28-29 — Illinois Custom Spray Operators' Training School, University of Illinois, Urbana, Ill.

California Group To Meet

The ninth annual convention of the Agricultural Aircraft Association, Inc. will be held Jan. 22 to 24 at the Senator Hotel in Sacramento, Calif.

A legislative panel will discuss the state licensing of pesticide salesmen, state aviation gas tax, and the aircraft responsibility law.

Members of the panel include: Robert Z. Rollins, California Department of Agriculture; Ivor R. Burden, of the Western Agricultural Chemicals Assn.; Stephen P. Teale, California State Senator; and Lloyd Lowrey, California Assemblyman.

Dr. Ralph Glasser, toxicologist, Shell Chemical Corp., New York, will discuss the practical aspects of safe handling of pesticides, and Norman B. Akesson, associate agricultural engineer, U. of California, Davis, will compare the use of agricultural aircraft in the

U. S. with their use in other countries. Mr. Akesson recently returned from a 14-month trip to England, Germany, Holland, East Africa, Australia, and New Zealand where he studied aerial application.

Col. Gregory "Pappy" Boyington, marine air ace of World War II, will be the guest speaker at the group's annual banquet during the meeting.

Safety with chemicals is to be discussed by Dr. Robert S. Ganelin of the U. S. Public Health Service, Phoenix, Ariz. Robert E. Monroe, assistant executive director of the National Aviation Trades Assn., Washington, D. C., is scheduled to speak on the wage and hour law as it pertains to the aerial applicator.

Another feature of the meeting will be a panel of insurance representatives discussing various aspects of aviation insurance and claims.

Among the aircraft and equipment to be demonstrated at the meeting are: the Grumman Ag-Cat, Transland's AG-2, the Snow S-2, the Rowden T-1, Fletcher's Utility airplane, the Kellett Autogiro, CallAir's new agricultural plane, the Piper "Pawnee," the Clark Model 1000, the Taylorcraft Topper, Champion airplanes, the Hiller Helicopter, and the Swathmaster distribution unit. In addition, films will be shown of the Swathmaster distributor and the Kellett Autogiro.

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Incorporate CallAir

The CallAir Aircraft Manufacturing Plant, Afton, Wyo., has filed incorporation papers with the Wyoming Secretary of State for the purpose of forming a new corporation to be known as CallAir, Inc.

Barlow H. Call, general manager, said that the purpose of the incorporation is to streamline the administrative, manufacturing, distribution, and selling functions of the plant and to make available for public purchase limited amounts of stock. The plant manufactures the CallAir agricultural airplanes and related components.

APPLICATING HINTS

In this issue, Agricultural Chemicals is starting a special column comprised of hints sent in by applicators who have tested their ideas or devices in actual practice. All applicators are invited to send us the details of any practice they feel might be of interest to others.

This month's applicating hints are sent in by John K. Medders of the Sun Valley Dusting Co., San Benito, Texas.

Corrosion Protectant

To protect the leading edges of struts and other exposed areas of our aircraft, we have used plastic electrical insulating tape for the past 18 months. The tape, once applied, remains in place with no re-sticking required and has completely protected the areas from corrosion caused by spray.

We have noted, however, that paint or primer, existing on the surfaces, should be thoroughly dry or cured before the plastic tape is applied so the tape will not pull the paint off if it must be removed. This tape is available at reasonable cost in 2 inch by 36 yard rolls from aircraft supply companies and 4 inch by 36 yard rolls can be obtained from electrical supply companies.

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Talc Base For Seed

We have found that premixing scarified small feed and cover crop seed on a low grade talc base has greatly enhanced broadcast planting by air. For example; when two pounds of seed per acre is desired, we mix ten pounds of seed with 90 pounds of talc and the mixture is applied at 20 pounds per acre. This method provides an even flow of mixed material and makes the seed visible enough from the air so that it can be flown as low as ten pounds per acre without a flagman, in reasonably calm air.

Any insecticide blending machine and some types of feed mills can mix seed in this manner at a nominal cost for bags and service.

Custom Operators' School

The eleventh Custom Spray Operators' Training School will be held Jan. 27 to 29 at the University of Illinois, Urbana, Ill. The school is sponsored by the Illinois College of Agriculture, the Extension Service, and the Illinois Natural History Survey.

In conjunction with the school, the Agricultural Spraying Association and the Illinois Aerial Applicator's Association will hold their annual business meetings.

Featured on the program for the training school are talks on liquid fertilizers, soil insecticides, brush control, and fungicides.

A number of sessions are scheduled for reports on weed control and crop damage from drift of herbicides. All sessions will be held in the Illini Union Building.

Aircraft Finish Spray

Super-Flite Aircraft Finish Spray now is available in 38 colors matched to the original manufacturer's aircraft paints.

Super-Flite is said to be easy to apply and long lasting. It is available in cellulose nitrate dopes, acetate butyrate dopes, and synthetic enamels.

LISTENING POST

By Paul Miller

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by cullaborators of the Mycology and Plant Disease Reporting Section, Plant Protection Research Branch, United States Department of Agriculture, Beltsville, Maryland.

Control of the Citrus Nematode, Citrus Brown Rot Fungi, and Weeds By Mylone Applied By Different Methods

R. C. BAINES, T. A. DeWolfe, and R. H. Small, of the University of California, wrote[1] that control of the citrus nematode, *Tylenchulus semipenetrans*, obtained in their experiments with Mylone (3,5-dimethyltetrahydro-3,5,2H - thiadiazine - 2 - thione) in 1953 and 1956 ranged from poor to excellent. Since the degree of control apparently was associated with the amount of water used with the chemical, they designed further tests to compare efficiency of different methods of application for control of the citrus nematode, and also of the citrus brown rot fungi, *Phytophthora citrophthora* and *P. parasitica*, and of certain annual weeds.

METHODS:

The authors made their tests in a field near Riverside. The soil was sandy loam without compacted layers and free from weeds, and the upper few inches was well cultivated. Field moisture capacity was between 11 and 12 per cent. When the tests were started, in June 1957, the top 4 or 5 inches of soil was relatively dry, but in the first foot there was 7.2 per cent and in the 1- to 4-foot zone 9 per cent of water. Soil temperature at 1 foot was 77° and at 2 feet 75° F. Soil temperature increased somewhat between treating and sampling. The soil was naturally infested with the nematode and *Phytophthora* spp.

Treatments were randomized in blocks, with four replications. Mylone 85W was applied at the rate of 470.6 pounds (equal to 400 pounds of active ingredient) per acre by two different methods. On half of the plots the chemical was mixed with sand and broadcast, rototilled into the surface, and rolled. To make basins for retaining water, metal rims 12 inches high and 4 feet in diameter were driven into the soil on the plots. Soon after the surface was rototilled, water was applied at the rates of 0, 2, 4, 6, 8, or 10 acre-inches. On the other half of the plots Mylone was mixed with water, at the same rates of water and chemical, and placed in basins on soil previously untreated.

About a month after treatment samples were taken with soil tubes to evaluate control of the nematode and of the brown rot fungi. The number and kinds of weeds that grew on the plots were also recorded.

RESULTS:

Nematode Control (Table 1): Although citrus nematode larvae were well distributed, the number in the top foot of soil was low. Mylone mixed with dry soil alone (treatment 2) was ineffective. The degree of control obtained and the depth to which the chemical penetrated increased with the amount of water applied, as shown by reduction in the number of nematode larvae, except that in the two treatments using most water after application of the dry material (treatments 6 and 7, irrigated with 8 and 10 inches of water), the chemical apparently was washed out of the top 2 feet of soil and control was poor in that soil zone.

Good control was also obtained from application of Mylone mixed with water (treatments 9 to 13). When 6 or 8 acre-inches of water was used used to apply the chemical, complete control resulted to the 4-foot depth. Two acre-inches gave control in the top foot of soil. All nematodes in the first foot and 68 per cent of the nematodes in the second foot were killed when 4 acre-inches of water was used. With 10 acre-inches, a few nematodes survived in the third and fourth feet of soil, but all in the top 2 feet were killed. Since the soil should have been wet to 9 or 10 feet down by 10 acre-inches of water it would seem, according to the authors, that the chemical accumulated in the top 2 feet in amounts sufficient to kill all the nematodes, but that not enough to be effective was carried lower in the soil.

Control of the Brown Rot Fungi: The authors state that distribution of the two species of *Phytophthora* in the experimental area was uneven. In the untreated plots (treatments 1 and 8, Table 1), both species were isolated from the top foot of soil, and occurred also at lower depths in a few cases. In the treated plots *P. parasitica*

(*Continued on Page* 112)

[1] R. C. Baines, T. A. DeWolfe, and R. H. Small, "Control of the citrus nematode, Phytophthora spp. and weeds by Mylone 85W when applied by different methods," *Plant Disease Reporter*, vol. 42, no. 7, pages 876-880, July 15, 1958.

Monsanto introduces the first truly non-caking ammonium nitrate fertilizer LION E-2

Now, for the first time since the development of solid prilled ammonium nitrate fertilizer, you and dealers everywhere may offer customers an ammonium nitrate that ends complaints and costly returns due to caking. It's Monsanto's new LION E-2 ammonium nitrate.

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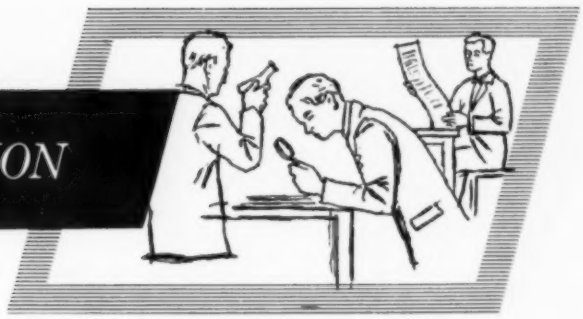
TECHNICAL SECTION



Organism Causing Dutch Elm Disease Sensitive to Captan

IN a preliminary study on possible absorption of captan from soil by several species of plants, *Ceratocystis ulmi*, the organism causing Dutch elm disease, was found to be very sensitive to captan *in vitro*. Residues of acetone extracts from leaves or stems were tested by bio-assay on agar plates seeded with *C. ulmi*. Greater inhibition of the fungus *in vitro* regularly occurred around residues from several species of plants growing in soil treated with captan when the rate was between 1 pound and 10 pounds per 25 square feet than when the rate was 0.1 pound or when the soil was not treated. Captan was not identified in any extract, but circumstantial evidence indicates that it or a closely allied chemical was present in the extracts from plants growing in treated soil. Inhibitory residues were obtained from humus-containing soils in the greenhouse and in the field several months after application of captan.

Chemicals that would prevent or restrict growth of *C. ulmi* within the host might be useful in control of Dutch elm disease, particulary if the chemical could be generally distributed in affected tissues including stems. In these experiments, if captan was absorbed by the roots of the elm trees, it concentrated in tissues of leaves rather than in stems, as indicated by the bio-assay test with *C. ulmi*.

Greater inhibition of *C. ulmi in vitro* regulary occurred around residues from organs (mainly leaves) of several species of plants growing in soil treated with Orthocide 50W when the rate of application was between 1 pound and 10 pounds per 25 square feet than occurred around residues from untreated control plants. At no time in these experiments was captan or a derivative identified as the agent responsible for inhibition zones about residues from treated plants. Consequently, it cannot be stated that captan was absorbed through the roots and concentrated in any tissues of the experimental plants. There is circumstantial evidence, however, that captan or a closely allied chemical was present in extracts from treated plants. The following findings support this view: 1) strong inhibition of *C. ulmi* by captan in bio-assay, 2) chemical injuries to leaves fully developed on elms at the time of the initial treatment with captan but absent from leaves on untreated plants, and 3) initially a greater inhibition by residues from plants treated at the rate of 1 pound per 25 square feet or more than from untreated plants. Absence of increased inhibition around residues prepared in autumn from the developing leaves of the Red Radiance rose possibly may be attributable to decreased root absorption rather than to decreased movement into the leaves because of the formation of an abscission layer.

Inhibitory residues were obtained from humus-containing soil both in the greenhouse and in the field for several months after application of captan or Orthocide 50W. In bio-assay, residues from comparable untreated soils always failed to inhibit *C. ulmi* when compared with extracts from treated soils. The odor of captan was readily distinguishable after 2 months in the soil in the rose plots treated at the rate of 10 pounds of Orthocide 50W per 25 square feet and after 6 months in the greenhouse in pots treated with much greater concentrations.

Curtis May, J.C. Palmer, and E. Haeskaylo, Plant Disease Reporter 42, no 5, 696-702 (1958).

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Dalapon In Waterfowl Areas

A report prepared by Edwin W. Ball of the U.S. Fish and Wildlife Service and printed in *Down To Earth*, a magazine published by the Dow Chemical Co., Midland, Mich., indicates that dalapon will control cattail and maidencane in southeastern waterfowl areas. Applications in the tests were made by airplane in low volume sprays.

In 1956, tests using aerial applications of dalapon to cattail were conducted at St. Mark's National Wildlife Refuge in north Florida, and on Mattamuskeet and Pea Island National Wildlife Refuge in northeastern North Carolina. A 20 pound rate was applied, but spray volumes varied in different plots. Results indicated 97 per cent kills in plots receiving eight and five gallons per acre. These high kills were still evident in the summer of 1957, with no regrowth developing. The indication that the lowest volume

used was as effective as the highest volume was significant, since the range in volumes adaptable for aerial application is limited.

Two 3-acre plots of giant cutgrass were established in tidal areas of the Savannah National Wildlife Refuge, and, in the summer of 1957, dalapon was applied at a rate of 10 pounds per acre in multiple treatments. By early October, results in one of the plots showed an 80 per cent surface reduction of cut-grass, but an exact final evaluation cannot be made until next spring.

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Japanese Beetle Fumigant

Ethylene dibromide treatments authorized to permit movement of nursery plants out of areas regulated because of Japanese beetles have been restricted in usefulness because a large volume of water has been required for the treatments. Recently, however, a method of injecting the fumigant in more concentrated form was developed and authorized.

W. E. Fleming and R. D. Chisholm, Entomology Research Division, and T. C. Cronin, Plant Pest Control Division, U.S.D.A., report on the new process in Agricultural Research Service Bulletin 33-47, May, 1958.

A miscible formulation containing 2.5 per cent of ethylene dibromide was injected into the soil with a veterinary hypodermic syringe with a stainless steel needle, modified to prevent soil from being pushed into it. Injection at the rate of 0.4 gram per square foot killed grubs in soil about the roots of plants in the nursery row. A rate of 0.4 grams per cubic foot also was indicated for the soil of plants growing in pots and other containers. For balled and burlapped nursery stock, 0.8 grams per cubic foot are required.

The insecticidal action was slower at low temperatures, in soils high in organic matter, and in very compact soils, but the water content of the soil did not seem to be a limiting factor.

Gibberellins For Hybrids

New hybrid plants now can be developed much more quickly with the growth-stimulating action of gibberellic acid, according to Dr. Reed A. Gray, plant physiologist for Merck & Co., Rahway, N.J., who spoke at a recent meeting of the American Institute of Biological Sciences in Bloomington, Ind.

Dr. Gray said that months may be saved in horticultural experiments by the speed-up gibberellins offer in eliminating the cold-storage period needed for the germination of certain seeds. In experiments, gibberellic acid completely replaced cold storage requirements to break the dormancy of peach seeds, Dr. Gray said. These results, he continued, indicate that gibberellic acid, used in treatment of non-cold treated peach seeds and other similar seeds, should speed up the breeding cycle and the consequent evaluation of new hybrids.

Gibberellic acid also is opening new possibilities in eventual control of crab grass, Dr. Gray reported. The growth-stimulant, he explained, greatly increases the germination percentage of crab grass seeds, making most of the seeds germinate at one time instead of germinating during all months of summer as they do normally. These findings suggested that gibberellic acid might be used in conjunction with crab grass herbicides according to Dr. Gray.

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Fluoroacetamide As Systemic

Further reports on the value of fluoroacetamide as a systemic insecticide are carried in the July 19, 1958, *Chemical Age*. In a recent paper delivered at the joint meeting of the Society of Chemical Industry and the Italian Chemical Society in Turin, Dr. M. A. Phillips referred to the high order of activity of fluoroacetamide, stating that it is effective in dilutions of 1 in 10,000 parts. It gave a 90 to 100 per cent kill when used as a systemic or contact insecticide.

This compound, however, is a very dangerous poison, being both highly toxic and rapid in action, and its general use has not been recommended. Acetamide and l-cysteine have been found to be protective substances against fluoroacetamide toxicity to mammals. Sodium fluoracetate, however, acts more rapidly in the mammalian system than does the relatively slow-acting amide; acetamide is not therefore antidotal to sodium fluoroacetamide poisoning.

The results of tests carried out in the United Kingdom indicate that fluoroacetamide is as effective as sodium fluoroacetate, the substance originally tested as a systemic. Residue tests on fluoroacetamide-treated sugar beet and cabbage indicate that the forbidden period for these plants is four to six weeks.

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Effects Of Wetting Agents

In an article in August, 1958 issue of *Manufacturing Chemist*, a British periodical, Dr. J. S. Stanley reports on the effects of wetting agents on agricultural sprays. The article notes that the effectiveness of the wetting agent will depend not only upon its wetting power, determined from surface tension and spreading measurements, but also upon the rate at which it can be absorbed at freshly formed surfaces.

While there is no simple method for predetermining an agent's effectiveness, the author indicates that recent studies, especially on the mechanism of spray retention and factors controlling run-off, have made it possible to lay down principles that can guide the formulators as to whether or not it is desirable to add a wetting agent to a particular product. The development of a wide range of commercial wetting agents, especially the dialkyl sodium sulphosuccinates and the unreactive non-ionic types, is said to simplify selection of the suitable agent for almost any spray concentrate.

TECHNICAL BULLETINS

STORED GRAIN PESTS. A 46-page study of grain pests with illustrations and diagrams. Fifty pests are described. Farmers' Bulletin No. 1260, USDA, Washington, D. C.

GROWING FLUE-CURED TOBACCO IN SOUTH CAROLINA by J. M. Lewis, extension tobacco specialist. A 23-page booklet of information gathered from latest experimental data and the practical experiences of South Carolina tobacco growers. Fertilizer recommendations are discussed in full. Circular 287, revised Jan. 1958, Clemson Agricultural College, Clemson, S. C.

FERTILIZATION OF CAMELLIAS. A report including nutrient element deficiency symptoms, effects of grades and rates of fertilizers, and influence of minor elements on camellia growth. Circular 125, June 1958. Agricultural Experiment Station of the Alabama Polytechnic Institute, Auburn, Ala.

ILLINOIS TREES AND SHRUBS: THEIR INSECT ENEMIES, by L. L. English. A 92-page report that aids in the recognition of insect pests of trees and shrubs and suggests specific measures of control. Circular 47, Illinois Natural History, Survey, Urbana, Ill.

AGRICULTURAL CHEMICALS HANDBOOK. A handy compilation of information on agricultural chemicals with a wealth of fundamental facts and basic principles of application, materials, and legal and health problems. Intended for use by tehnicians, field men, county agents, pest control license applicants, and commercial operators. Available from The Student Book Corp., State College of Washington, Pullman. Price is $1.

CONTROL OF SLUGS, SOWBUGS, CENTIPEDES, AND MILLIPEDES IN THE GREENHOUSE AND GARDEN, by John C. Schread. The seventh in a continuing series of publications on research conducted at the Connecticut Agricultural Experiment Station to control pests on ornamentals. Circular 203, May 1958. Connecticut Agricultural Experiment Station, New Haven.

USE OF INSECT REPELLENTS. A USDA publication that gives information on the availability, use, and effectiveness of repellents for mosquitoes and other biting flies, chiggers, fleas, and ticks. The information was compiled by Carroll N. Smith, I. H. Gilbert, and H. K. Gouck. ARS-33-26, revised April 1958. U. S. Department of Agriculture, Washington, D. C.

SULFUR IN RELATION TO SOIL FERTILITY, by L. E. Ensminger, soil chemist. A report covering the sulfur data obtained by the Alabama Agricultural Experiment Station over a period of nearly 20 years. Bulletin 312, June, 1958. Alabama Experiment Station of the Alabama Polytechnic Institute, Auburn, Ala.

GRANULATED INSECTICIDES FOR CONTROL OF THE EUROPEAN CORN BORER IN FIELD CORN, by H. B. Wressell. A booklet listing insecticides, rates and times of application, and equipment for controlling the corn borer. Publication 1014, revised March 1958, Canada Department of Agriculture, Ottawa, Canada.

MAGNESIUM STATUS OF BLACKLAND SOILS, by J. D. Lancaster. On the basis of several field experiments and chemical analysis, magnesium deficiency in cotton is indicated only in the Blackland area of Northeast Mississippi. Bulletin 560, June 1958. Agricultural Experiment Station, Mississippi State University, State College, Miss.

Insect Resistance Study

The Connecticut Agricultural Experiment Station, New Haven, has published a report by Raimon L. Beard on the relation of insecticide resistance to physiologic strains. The report is contained in Bulletin 611 of the station.

The practical stimulus for the study was the hypothesis that variation in responses by single individuals might account for less resistance developing to the quick-acting transient insecticides than to the slower acting persistent insecticides. An insecticide like pyrethrum might act much as a "single exposure" in that the survivors of one treatment could be just as susceptible to a second treatment as the original group was to the first. By inference, some of the survivors would be genotypically resistant, but they would be diluted by other survivors which were "resistant" only at time of treatment.

An insecticide like DDT, on the other hand, by its residual properties acts repeatedly on the same population, gradually eliminating those individuals which are only apparently resistant. All the ultimate survivors would be presumed to be genotypically resistant.

As a contribution to the understanding of the development of resistance in insects, these studies were concerned with the variations that occur in the insect population and the selecting mechanisms that act on the variable population to result in segregation of physiological strains by inheritance.

NEW BOOKS

The Principles of Biological Control, by Harvey L. Sweetman. This book is a revision and extension of an earlier book on biological control, written by Dr. Sweetman in 1932. The use of host resistance and the importance of environmental influences in counteracting pests are among topics covered. All groups of organisms from the lowest to the highest forms that are useful or show promise in the control of pests are considered. The control of pest plants by insects and other biological agents is treated in a final chapter.

Dr. Sweetman is a professor of entomology at the University of Massachusetts, Amherst.

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Diseases of Tobacco, by Dr. G. B. Lucas. Published by the Scarecrow Press, Inc., New York. Price $10.

Based on a comprehensive survey and an assessment of pertinent literature, this book gives an up-to-date treatment to the subject. All tobacco diseases of economic importance are discussed; including nematode, fungus, bacterial, virus, and malnutritional diseases, as well as injuries and genetic abnormalities. Each disease is discussed from the viewpoint of distribution, economic importance, symptoms, causal agent, environmental effects on disease severity, and control.

Dr. Lucas is associate professor of plant pathology at North Carolina State College, Raleigh.

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Modern Chemical Processes, Vol. 5. Published by Reinhold Publishing Corp., New York. 8½ x 11¼ inches, cloth binding, 154 pages. Price $5.00.

The fifth in a series of volumes describing chemical manufacturing processes including articles on: Granulated Fertilizers by Continuous Ammoniation; and Granulated Triple Superphosphate.

NOW...ONE MIDWESTERN SOURCE FOR THREE BASIC FERTILIZER MATERIALS

With the addition of a phosphatic solution plant to its chemical complex at Tuscola, Illinois, U.S.I. can now supply a large area in the Midwest with a variety of fertilizer materials that will meet all your needs for these components:

PHOSPHORUS . . . in the form of Phosphatic Fertilizer Solution (wet process phosphoric acid, 54-55% P_2O_5). This is available from U.S.I.'s new plant which produces 30,000 tons/year of P_2O_5. This chemical frequently enables you to make your regular and special granular grades of fertilizer at lower cost . . . and to make higher analysis grades.

NITROGEN . . . available as anhydrous or aqua ammonia, plus 16 types of nitrogen solutions including urea types.

SULFURIC ACID . . . available in all concentrations including oleum, plus good spent acid of fertilizer quality. Plants, not only in Tuscola, but also in Sunflower, Kansas, and Dubuque, Iowa.

To help you make the most of these various products, U.S.I. Technical Service people are ready to work with you. The U.S.I. Engineer will help you trouble shoot, set up formulations, work with you on experimental runs, consult with you on equipment selection, and can also offer U.S.I.'s laboratory facilities for more intensive investigations.

For products or assistance from U.S.I. Technical Service Department, write Heavy Chemicals Sales.

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WASHINGTON REPORT

By Donald Lerch

WHAT does the future of farming hold for manufacturers of fertilizers and pesticides? Here is what one top farm advisor, H. L. Ahlgren, director, Agricultural Extension Service, University of Wisconsin, predicts for agriculture in the next 15 to 25 years.

1) An expanding industry in every aspect except numbers of people involved. The number of farms will continue to drop from just under 5 million now to 1½ million commercial farms and a number of part-time farms 25 years hence.

2) Farm operators will depend upon more capital, more science, and improved farm management to produce the increasing quantities of food needed. This means buying more production items.

3) More farm products will be produced according to specification and under contract to distributors and marketers. Greater knowledge and management skill will be needed to produce food and fiber crops under these conditions.

4) The farmer's most important need in coming years will be new knowledge and information on how to apply it on the farm. Changes are taking place so fast, that only the farmer who is using the most modern methods can expect to take full advantage of opportunities to boost efficiency, produce according to specification, and raise his farm income.

Tallied up, the predictions indicate that manufacturers, formulators, distributors and dealers who keep farmers completely informed on new developments and how to apply them will benefit most from expanding sales of production items such as fertilizers and pesticides.

One factor will be in the manufacturer's favor. As the years go on, the men to whom they will be selling will be better educated, more knowledgeable about the benefits of agricultural chemicals, and better able to judge a useful new material or practice when it is presented.

* * * * *

Don't underestimate the impact Agriculture's Hall of Fame is going to have upon the public when it opens. Dr. A. Webster Tenney, a specialist in agricultural education for the U. S. Office of Education the past 14 years, has just been employed as the Hall of Fame's executive director.

His idea is that the Hall of Fame will be "agriculture's great opportunity to tell its story to the world in a moving, dynamic manner." The Hall of Fame, he feels, will "provide a common ground on which agriculture, science, government and industry can come together and solve common problems."

Members of the agricultural chemicals industry will want to keep a close watch on development of Agriculture's Hall of Fame. It may offer the industry a good opportunity to get across the story of the contributions that chemicals have made to our current era of agricultural abundance.

* * * * *

U. S. D. A. and Florida Plant Board officials are quietly pleased by the successful eradication of the Mediterannean fruit fly from Florida. Some professional scoffers predicted that no pest could be eradicated. Now, it has been proved that effective and proper use of chemicals can do the job.

Reason for the pleased feeling among plant pest control officials is that November 26, 1958 marked a full year since the Medflies were wiped out in Florida. Not a single Medfly has been found during the past year.

The conclusion everyone but the crackpots is making is that prompt use of chemicals has saved Florida's $400 million-a-year fruit and vegetable industry from a major disaster.

* * * * *

At a little publicized meeting here recently Arthur S. Flemming, Secretary of Health, Education and Welfare, expressed interest in solving two of the agricultural chemicals industry's knottier problems.

One is the discrepancy between state and federal food and drug laws and regulations. The other is the public's need for more positive information about the high quality and safety of the foods reaching consumers.

Special emphasis was given both areas both by Secretary Flemming and by FDA Commissioner George P. Larrick. Commissioner Larrick and Deputy FDA Comissioner John L. Harvey assisted in presiding at the meeting.

In the view of industry leaders, progress in both areas would result in benefits to agriculture, to consumers, and to manufacturers and distributors. Discrepancies between federal and state food and drug laws, for example, now present obstacles to setting up tolerances in a number states. States which have adopted laws uniform

with federal laws, can accept the federal tolerances by regulation.

Secretary Flemming in no way underestimated the difficulty in gaining uniform state and federal laws and regulations. For many years the Association of Food and Drug Officials has promoted a uniform state law. Recently AFDO invested $2500 in an effort to set up a nation-wide study of discrepancies.

More than a study is needed. Secretary Flemming urged a citizens advisory group be organized to aid in the study. The citizens group also could stimulate states and localities to adopt uniform laws and regulations to improve over-all protection of the public and to ease problems for those now forced to make products conform to a patchwork of laws and regulations.

Great interest was shown, too, in improving HEW's information efforts. Secretary Flemming said HEW has a position of leadership to maintain and one way to exercise it is through improved information services. Commissioner Larrick reported that FDA recently expanded its information effort, would like to enlarge it further, and will welcome additional facilities in getting accurate and well-balanced information to the general public. Secretary Flemming stressed particularly the need for getting more positive information to the public about what is being done to assure the public of safe, sanitary and wholesome food.

Purpose behind the special meeting was to acquaint Secretary Flemming with the problems of food and allied industries, such as agricultural chemicals. Heads of some 280 trade associations were invited, and most attended; including NAC President J. V. Vernon.

Mr. Vernon told Secretary Flemming he believed that simplified procedures for toxicity determination and registration of products for use in agriculture can be worked out and that work is proceeding along these lines. Otherwise, he said, "I feel confident that diligence in cooperative attitudes working toward the common goal of making the use of pesticides a safe and sound practice will have resulting benefits to agriculture and the public in general not only in this country but throughout the world."

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Both fertilizer and pesticide makers stand to benefit from the vote of cotton farmers to accept marketing quotas again for 1959. The vote now gives cotton growers the opportunity to expand the number of acres planted to cotton from 12,402,000 in 1958 to about 18,300,000 in 1959.

The 1959 marketing quota program offers cotton growers two plans. Under Plan A they can stick with allotments assigned by the Government and get support prices at not less than 80% of parity. Under Plan B they can overplant by 40% and get price support at 15% less than under Plan A. The betting is that the more efficient growers will take Plan B in order to enlarge their profits.

This is why current estimates in Washington are that cotton acreage will be up by some 6,000 acres in 1959. More fertilizers and more pesticides will be needed to bring this larger crop to market.

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In carrying forward its program of promoting better soil testing, NPFI has just made a $2,500 grant to the Alabama Agricultural Experiment Station, Auburn, Ala., to suport research to improve soil testing methods.

A primary objective of the research will be to determine the response of forage crops to phosphate, potash and lime as related to soil tests. Research will be carried out in a minimum of 20 locations.

FDA Approves Microbials

Marketing of food and feed crops that are treated with a microbial pesticide, *Bacillus thuringiensis Berliner*, will be permitted under a temporary exemption from the requirement of a Food and Drug Administration tolerance, Commissioner of Food and Drugs George P. Larrick announced last month.

Referring to the new pesticide as a possible useful "bacteriological warfare" agent against certain insects, Mr. Larrick pointed out that the FDA exemption provides authorization for the first time to apply this type of pesticide directly to food crops. Milky disease bacteria have been widely used for control of Japanese beetle, but these have been applied only to the soil, not directly to crops.

The Food and Drug Administration action was taken in connection with the granting of an experimental permit for one year by the U. S. Department of Agriculture to the manufacturer of the new pesticide, Pacific Yeast Products, Inc., Wasco, California. Under the U.S.D.A. permit, distribution is planned to selected growers in 16 States, Puerto Rico, the Territory of Hawaii, and Australia. The substance will be applied as a dust or spray to protect crops against insect pests including cabbage looper, imported cabbage worm, alfalfa caterpillar, and certain other moth-type insects that, in the worm stage of growth, feed on and destroy crops.

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ACS Division Elects Strong

Dr. Frank M. Strong, professor of biochemistry at the University of Wisconsin, has been elected chairman of the American Chemical Society's Division of Agricultural and Food Chemistry for 1959. He succeeds Dr. H. L. Haller of the United States Department of Agriculture, Washington, D. C.

Dr. Lloyd W. Hazleton of the Hazleton Laboratories, Falls Church, Va., was named chairman-elect of the ACS division, and Dr. John H. Nair III of the Mellon Institute, Pittsburgh, was re-elected secretary-treasurer.

Professor Strong has carried out important studies on the chemistry of the B vitamins, and the distribution in food of vitamins and amino acids.


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INTERNATIONAL'S
FULL ORBIT SERVICE
A new world of service for '59
trains
your men for
MAKE-MONEY
SELLING
Here is the sales training program tailored to your fertilizer market. It leads. Suggests. Assists. Charts new strategy ideas. It's a dramatic common-sense approach to the greatest art of all — selling!
And, Full Orbit '59 offers a "World of New Services":
• New guidance in Insurance, in Safety, in Credit and Collection.
• More detailed Merchandising Aid.
• Action Kits with visual helps for your use in YOUR programs.

Full Orbit Service '59 ..."in the field" training for your salesmen

Full Orbit's new training program fights the order-taking school—makes salesmanship your top profit builder!

In 1959, International's Full Orbit Service takes another giant step forward in the fertilizer industry — working closer than ever before with you in building sound sales programs to help sell more fertilizer *profitably*.

The Full Orbit Service customer sales training program is planned by experts in the fertilizer business. It has been launched because aggressive fertilizer manufacturers across the country expressed a great need and desire for such a program.

From January 1 to February 15 International's Full Orbit sales training staff will hold eight meetings located in areas most convenient for fertilizer manufacturers to attend.

Specifically tailored to the fertilizer market, these unprecedented meetings dig down to the roots of effective selling of fertilizer — and build the power of personal contact that makes a sales organization click. *Not a "do-it-yourself" program, this Full Orbit service is a "we-do-it-together" plan that discusses common problems with logical and practical solutions.*

Here are just a few of the subjects to be covered:

Prospecting for new accounts; hitting pay dirt on the first call; giving your product that silver lining; how to make every minute of your selling time count.

Every phase of these meetings is aimed in one direction — and that is helping your salesmen to sell fertilizer more *profitably*.

From sales training to even stronger selling service, Full Orbit leads the way to more aggressive merchandising.

Full Orbit '59 is an all-out effort to help you improve every phase of your business . . . "on the spot assistance is yours for the asking." Your International representative has been trained and equipped to work closely with you in solving your every merchandising problem.

New "Full Orbit Action Kits" provide you with workable tools for use in developing stronger advertising, manpower, meeting and market analysis programs. Ask your IMC representative about these valuable working tools.

New services and stronger services — plus new areas of service, Full Orbit is geared to your needs.

Example, New . . *Credits and Collections:* The business way to establish credit; methods of determining risk; how to handle credit paper; selling through credit; how to restrain customer credit; credit education. Collection . . . how to handle past due accounts; considering the debtor; establishing a fair, insistent collection policy; how to suit collection policy to the fertilizer trade.

Detailing the second new program . . . *Insurance and Safety:* The facts and fundamentals of setting up in-plant insurance and safety programs; employee insurance; the benefits to you and your men.

And it's all practical, successful information flavored for the fertilizer firm on the grow — to spark still further improved customer service and bring an up-swing in your sales curve.

"It's a packaged plan geared for a fertilizer man's needs"
"A good constructive step ahead"
"Impressed that IMC is placing their entire facilities at our disposal"
"Already helped us revamp market plans"
"Changed distribution and cut out low-volume grades"

Tested and proved --

FULL ORBIT SERVICE

already is charting new strategy in profitable fertilizer selling

SEE FULL ORBIT IN ACTION

Full Orbit Service picks up where others leave off. More than product or technical help . . . it reaches deep into every phase of the fertilizer business, puts practical field knowledge and methods of operation at your fingertips. New buyer-supplier teamwork powered to help you sell more goods at less cost.

Here are the services that primed Full Orbit Service just a few months ago.

Market ideas for growing . . . helps you detail a stem-to-stern knowledge of your market — the facts — about size, potential, brand acceptance; realistic sales goals; where to aim production; build a tailor-made sales staff.

Sales manpower with impact . . . how to arm salesmen with the "plusses" that make sales click; determine your manpower needs; holding meetings; developing the sales approach; building a more productive staff.

Pay-off meetings that produce . . . what makes a successful meeting; meetings for salesmen, dealers, farmers; preparation; follow-through; presentation.

Promotion dollars with impact multiplied . . . starts with budgeting . . . carries through media; preparation; planning; writing; newspapers, radio, TV.

Technical service that trims out trouble . . . on-the-spot technical help with acidulation, formulation and production processes; equipment, engineering, research.

Transportation powered for results . . . covers rates; damage and loss; routing; shipping your products; even plant location studies to get low-cost service.

Every one is keyed to your International representative — the man to call and see to help build a solid foundation in every area of fertilizer merchandising. Each phase is a complete program, detailed, vigorous . . .

EXAMPLE—how Full Or

take the trouble out of Triple

Triple Superphosphate follows many routes along the transportation ways. Whether you're concerned with products you buy from us — or products you sell to your customers — whether it moves by rail, barge or vessel — Full Orbit Service '59 masters the maze of shipping problems and makes costs toe the profit line.

RATE NEGOTIATIONS

Many shippers look upon freight rates as fixed costs about which little can be done. Fact is, Full Orbit Service points the way to equitable charges. Carries your problem to rate control boards, works through associations, or helps solve the problem independently. Experience is the key. Annually IMC ships over 3,000,000 tons of phosphate rock alone. You benefit from efforts that hold the line on costs.

LOSS OR DAMAGE TO SHIPMENTS

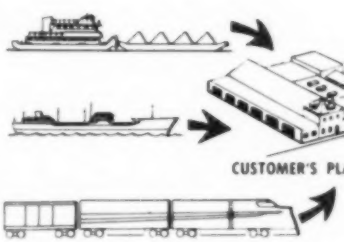
Although no mode of transportation is completely free from loss or damage, Full Orbit Service looks to minimize it in every way. Should loss or damage occur, Full Orbit goes to work through IMC specialists to immediately correct the fault. When the claim can be collected from the carrier, Full Orbit Service handles it for you. In many cases IMC can allow immediate credit so your money isn't tied up in long-range negotiation.

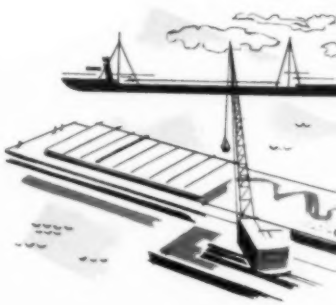
SHIPPING YOUR PRODUCTS

Full Orbit Service is a part of your business . . . interested in your success and a smooth-running fertilizer plant. That's why IMC can help solve transportation problems with the product you ship your customer. A simple change in loading cut damage for one manufacturer; inexpensive storage bins speeded delivery for another. This transportation trouble-shooting is yours for a call.

ROUTING

Full Orbit Service can show you how to end car bunching that skyrockets costs and squeezes the production schedule. Proper routing, designed through years of experience, can be yours — another Full Orbit Service. One company batches directly from cars. Full Orbit solved it with daily 2-car shipments to their siding. The customer is free of demurrage, storage or plant congestion problems.





rbit Transportation Services

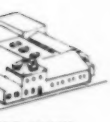
le Superphosphate deliveries

PLANT LOCATION STUDIES

Should you locate your plant near your largest sales area? Should it be near water to take advantage of low-cost barge shipments? What about nearness to large cities so your customers who bring products into town can return with materials? Full Orbit Service will prepare rate charts — inbound and outbound — plus full-range transportation information to help you make the right decision.

MISCELLANEOUS SERVICES

Full Orbit Service provides rates for all forms of transportation to help you decide where to buy your materials. Interpretation of laws and regulations, too, help you with specific rulings on specific problems. As part of Full Orbit Service, IMC will trace, reconsign or hold shipments at your decision. Follow it, divert it to another plant, hold it if a plant-side backlog needs more unloading time.



SHIPPING FACILITIES AT IMC

Take phosphate chemicals for example . . . from Bonnie, Florida, material moves by rail or vessel . . . rerouted by barge for inland water routes. This furnishes a "rolling warehouse" and a "floating warehouse" that can be diverted anywhere along specific routes. Result: Product is never more than 3 days away and many times only a matter of hours. Tank farms of phosphoric acid too speed delivery.

LOADING FACILITIES AND TECHNIQUES

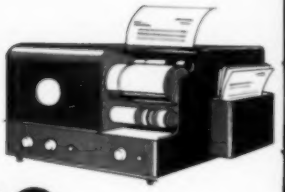
Full Orbit Service begins at home with IMC . . . modern techniques and a full schedule keep product rolling to you, and keep quality uniform. Example: during the shipping season cars are loaded 24 hours a day at Bonnie, Florida. *Always under cover.* Each shipment is inspected at time of loading in a final series of quality control checks. Bags are stacked with the key-sack method to reduce damage.

The men who make transportation click

IMC sales and transportation men are available to help you any time, any way possible. They are I.C.C. Practitioners with full knowledge of transportation law. They appear before all rate bodies in various sections of the country. They know their way around transportation offices and associations devoted to fair transportation practices. Their purpose: to serve your interests. Also they can keep you informed on the latest costs affecting rail, barge or vessel shipments. A call puts them on your staff.

FULL ORBIT

introduces a new Potash order service



minutes after you order potash it's on the way from International

Your order speeds across IMC teletype to Carlsbad . . . processed minutes after it's placed.

Fast! That's the only word for International's streamlined new order service.

In less time than it takes to tell about it, your potash order is speeded on wings of wire over IMC teletype . . . direct from district sales office to Carlsbad with no stopovers, no relay delays.

Within minutes, your car is being processed. The number is wired back to you immediately . . . often the same day you order. East Coast, West Coast . . . wherever you're located, your car of International Minerals potash rolls in when you need it.

Fast delivery is a Full Orbit Service specialty. We could go on and tell you about International's high-quality potash . . . uniform grade and size . . . the variety of product to meet your needs . . . dependable supply. But anyone who KNOWS International's potash KNOWS this.

POTASH FOR AGRICULTURE

International is the only supplier who produces all five potash products:

STANDARD MURIATE OF POTASH (60% K_2O minimum)

COARSE MURIATE OF POTASH (60% K_2O minimum)

GRANULAR MURIATE OF POTASH (60% K_2O minimum)

SULPHATE OF POTASH (50% K_2O minimum)

SUL-PO-MAG* (Sulfate of potash-magnesia bases 40% K_2SO_4 and 55% $MgSO_4$)

*Trademark, International Minerals & Chemical Corporation

Creators of Living Minerals

MINERALS International CHEMICALS

Your International representative can put Full Orbit Service '59 to work for you. He'll help you build your sales strategy around this dynamic new concept of buyer-supplier teamwork . . . to generate giant strides ahead in fertilizer production and selling.

Phosphate Division • Potash Division

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

Administrative Center — Skokie, Illinois

By Vincent Sauchelli

Dr. Sauchelli is Chemical Technologist for National Plant Food Institute.

Nutritional Qualities and Fertilizer

FERTILIZERS have been discussed as an aid to the maintenance of soil fertility, and also a means by which the level of soil fertility is raised sufficiently to permit better varieties of crops to be grown profitably in newer and more productive systems of agriculture. They have also been described as playing an essential role in assuring more cheaper food and raw materials for industry. Fertilizers are all that, indeed; but I believe that they also play a vital part in maintaining and improving the nutritional value of food. What follows will discuss briefly this phase.

In the fertilizer industry, three chemical elements dominate in the purchase, manufacture and sales functions; to wit, nitrogen, phosphorus and potassium. Materials furnishing these elements in various chemical combinations are therefore grouped as fertilizer raw materials. The plant nutrients in these materials are present in different degrees of stability and availability. It is often necessary to subject them to mechanical and chemical treatment in order to make the nutrients available to plant life. This is especially true of materials containing phosphorus and organic nitrogen. Sulfuric acid is the chemical reagent most commonly used for this purpose and hence sulfur is justly classed as a fertilizer raw material. Moreover, sulfur is an important plant nutrient as essential in the building up of the protein molecule as are phosphorus and nitrogen—a fact which is not commonly emphasized sufficiently.

Green plants are the primary source of nitrogen for man and beast and they are derived almost entirely from inorganic matter. All the essential chemical elements for growth and reproduction in plants are derived from soil, air and water—some sixteen elements in all. The minerals essential to life may be divided into two classes: the major elements needed in relatively large amounts and the minor or trace elements needed in small amounts. For most living organisms the major elements include nitrogen, phosphorus, potassium, magnesium, calcium and sulfur. Animals need, in addition, sodium and chlorine and, probably, plants require these as well. The trace elements include iron, zinc, copper, manganese. Molybdenum, boron and vanadium also are required by plants and iodine, fluorine, cobalt and probably molybdenum are needed by animals. The fact that trace elements are needed in very small amounts does not mean they are less important to life than the major elements.

This brief introduction to plant nutrients may serve to set the background for the following comments.

Now, the question is, can fertilizers influence the nutritional values of crops? The effect of fertilizers on the chemical composition and nutritional value of plants has been investigated at many of our agricultural experiment stations. The results of these studies have not always been in close agreement due, in many instances, to the wide variations in the climate and the mineral content of the soils in different areas of the country. Climate factors, that is, rainfall, humidity, sunshine and soil moisture, decisively influence the chemical composition of a crop and very often cause a greater variation than does the presence or deficiency of plant nutritive elements. Despite the many difficulties met with in the attempts to answer the question precisely, it may be affirmed that fertilizers can and do favor the nutritional value of food crops.

In support of this it may be proper to quote authorities recognized as competent in this field:

Dr. L. A. Maynard: "Soil factors certainly influence the content in our food crops of the minerals that are needed in animal and human nutrition. The importance of the soil in relation to mineral deficiency troubles in grazing animals, notably phosphorus deficiency, is well known. Recent studies have uncovered widespread areas of cobalt deficiency in the United States and indicated that trouble caused by lack of manganese, copper and perhaps other trace elements occur as well."

Rothamsted (England) Agricultural Experiment Station: Evidence at this famous research station collected over many years of continuous plot-testing shows these averages for protein increases per acre from the use of 100 pounds sulfate of ammonia: barley, 23 pounds of extra protein; oats, 21 pounds; wheat, 27 pounds.

(Continued on page 106)

PHOSPHORIC ACID

From The Country's Largest And Most Dependable Source Of Phosphate Products For High Analysis Formulations

TRIPLE SUPERPHOSPHATE—RUN-OF-PILE • GRANULAR • COARSE

Phosphoric Acid of highest purity
to assist you in reducing
formulation cost and maintaining
consistent, uniform high quality
in all your phosphate processing.

Manufactured to the following specifications:

52-54% P_2O_5
Solids less than 1% by weight
Specific Gravity: (60°F) 1.68-1.73

Available In Rubber Lined Tank Cars.
Technical Service Available at Your Request.

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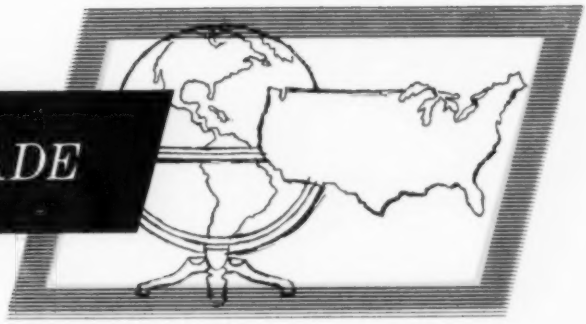
NEWS about the TRADE



Form Canadian Division

Panogen Co., Ringwood, Ill., a division of the Morton Chemical Co., Chicago, Ill., recently announced that Panogen products are being distributed in Canada by Panogen of Canada, Ltd., Winnipeg, Manitoba. The new company is a wholly owned subsidiary of Morton.

William J. Crist is manager of Canadian sales and is concerned with the distribution of Panogen and Drinox liquid seed treatments, Larvacide fumigants, and other products and seed treating equipment manufactured by Panogen. Mr. Crist joined Panogen as its first salesman in February 1953.

•

Use Hot Granulation Process

The Farmers' Co., Ltd. has constructed a factory for the manufacture of 30,000 tons a year of granulated concentrated compound fertilizers at Misterton, Gainsborough, England.

The company will use a hot granulation process whereby it is possible to manufacture granlated concentrated mixed fertilizers containing plant food ratios of over 25 nitrogen to one phosphorus and 2.5 potassium to one phosphorus. On this basis, fertilizers containing up to 50 plant food units have been produced, the company reports.

•

Miller Moves Office

The general sales office of the Miller Chemical & Fertilizer Co. has been moved to the new "Miller Chemical" building at 3006 West Cold Spring Lane, Baltimore 15, Md.

•

Form Chemical Company

Regional Chemicals, Inc., has been incorporated at Seattle, Wash., by George Mock and Jennings P. Felix. The firm will engage in wholesale and retail distribution of chemical products, including Slugfest, in Washington, Oregon, Idaho, California, and Canada.

•

California Weed Meeting

The practical aspects of weed control will be the theme of the 11th annual meeting of the California Weed Conference, Jan. 20, 21, and 22 in the Miramar Hotel Auditorium, Santa Barbara, Calif.

Weed control authorities will discuss administrative problems of roadside weed control, modern weed control, weed control on military installations, urban weed control with emphasis on smog control, and public utility weed problems. Other talks will cover wetting agents, turf, and weed control on row crops.

Swift Mgr. of AC Division

J. E. Benson has been appointed manager of Swift & Company's Agricultural Chemical Division at Albany, Georgia, succeeding A. N. D'Aubert who died in October. Mr. Benson is a native of Georgia and joined Swift at Atlanta in 1946.

•

IMC Regional Meetings

The International Minerals & Chemicals Corp., Skokie, Ill., is sponsoring a series of nine regional training meetings for 350 salesmen of 156 fertilizer companies.

IMC president T. M. Ware said that the program already has set a new standard of customer-supplier relationship.

The agenda for the meetings includes such topics as sales approach, overcoming objections, sale closing, general sales tools, selling quality, and effective use of selling time.

Starker Joins Gandy Company

Charles H. Starker has been appointed sales promotion director of the Gandy Co., Owatonna, Minnesota. Mr. Starker, who will make his headquarters in Owatonna, will travel nationally, working with the manufacturers of granular chemicals, with Federal and State research and educational authorities and with farm implement distributors and dealers. His primary responsibility will be to further the use of granular agricultural chemicals and Gandy applicating equipment.

A native of Oregon, he is a graduate of Oregon State College, with a B.S. in entomology. From 1937 to 1941 he did entomological field work for the Oregon Experiment Station.

After four years with the U.S. Army, he was employed as research entomologist with Pacific Cooperatives of Portland, Oregon. After eleven years with Pacific, Starker left to join the Los Angeles Chemical Co., Los Angeles, as assistant manager of their Insecticide Division.

Mr. Starker is a member of the Entomological Society of America, and has served on several committees of the Pacific branch of this organization. He is past president of the Oregon Entomological Society and has served on the board of directors of the Western Agricultural Chemical Association.

C-I-L Plant Manager

A. A. Perley, superintendent of the ammonia plant of Canadian Industries Ltd. at Millhaven, Ontario, has been named to the newly-created post of plant manager. R. L. Stevens has replaced Mr. Perley as plant superintendent.

•

Penick Moves Headquarters

The general offices of S. B. Penick & Co. and its New York Quinine & Chemical Works Division have moved to 100 Church Street, New York. The move was made to modernize the company's facilities and to consolidate its operations. Since 1940, Penick had been located at 50 Church Street, where NYQ joined the parent company in 1951.

•

Montrose Plant In Mexico

Montrose Mexicana, S.A. last month began operation of a new DDT plant at Salamanca, state of Guanajuato, Mexico. The plant has a capacity of 15 million pounds of DDT per year, as against current Mexican requirements of nine million pounds annually.

A majority interst in Montrose Mexicana is held by Nacional Financiera together with a group of Mexican shareholders. The minority interest is held by Montrose International – jointly owned by Montrose Chemical Co., Newark, N. J., and the Stauffer Chemical Co., New York.

The new plant will rely upon Mexican raw materials and will distribute DDT to insecticide mixing plants throughout Mexico.

•

CFF Buys Interest In NPC

The Central Farmers Fertilizer Co., Chicago, and the National Potash Co., New York, have signed an agreement which calls for the acquisition by Central Farmers of a stock interest in National Potash and the production by National Potash of potash materials for distribution by Central Farmers.

Delivery of potash to Central Farmers will not commence until July 1, 1959. National Potash, the newest entrant in the potash industry in this country, began operations in 1957. It has mining and processing facilities near Carlsbad, N. Mex., and undeveloped additional reserves.

•

With Cyanamid 40 Years

Frank S. Washburn, general manager of the Agricultural Division, American Cyanamid Co., New York, celebrated his 40th year with the firm on December 3, 1958.

The organization was founded by his father, Frank S., Sr. in 1907 as a one-plant, one-product (calcium cyanamide) company. Mr. Washburn joined American Cyanamid eleven years later as a field representative. At that time the company was building its organization on three basic fertilizer products, cyanamide, Ammo-Phos and phosphate rock. Today the firm produces over 6000 products for every conceivable industry.

New Shell Organization

Shell Chemical Corporation president Richard C. McCurdy announced a company reorganization effective Jan. 1, 1959, involving the formation of four additional fully-integrated divisions, bringing the total of these to five. Each division will be headed by a general manager and will engage in one of the five main lines of business of the company. These are agricultural chemicals, ammonia, industrial chemicals, plastics and resins, and synthetic rubber.

The new agricultural chemical division will be headed by Sumner H. McAllister, now manager of the agricultural chemical sales division.

The ammonia division, already an integrated operation, will be headed by Lawrence M. Roberts, now manager of operations in that division.

NEWCC To Review New Herbicides January 7-9

PROMISING new developments in weed control, the evaluation of new herbicides, progress reports on herbicide investigations, and all other phases of weed control were scheduled for discussion at the thirteenth annual meeting of the Northeastern Weed Control Conference, to be held Jan. 7, 8, and 9 at the Hotel New Yorker, New York City.

Presiding at the general sessions were NEWCC president, S. N. Fertig, Cornell University, and vice president L. G. Utter, Diamond Alkali Co. Some 400 representatives of industry, government, and the experiment stations were expected to attend and participate in sectional meetings dealing with: (1) Horticultural Crops, (2) Agronomic Crops, (3) Industrial and Highways, (4) Public Health, and (5) Aquatics, Conservation and Forestry.

Among the reports scheduled was: an "Evaluation of New Chemicals for Pre-emergence Crabgrass Control," by J. E. Gallagher and R. J. Otten, Amchem Products; "Weed Control in Corn," by J. A. Mead and P. W. Santelmann, University of Maryland; "Results of Foliar and Granular Applications to Mixed Brush in 1957," by W. E. Chappell and R. E. Sayre, Va. Agricultural Experiment Station; and "Emulsification of Herbicides," by J. Wade Van Valkenburg and J. A. Kelly, Dow Chemical Co.; Several papers deal with aquatic weed control in the eastern states, and a report from the coordinating committee on aquatics is to be given by P. F. Springer, U. S. Fish and Wildlife Service.

Committee chairmen for the 1959 meeting are: Program—P. W. Santelmann; Coordinating—M. M. Schreiber; Publications – D. A. Schallock; Sustaining Membership —L. Southwick; Public Relations—E. R. Marshall; and Awards—C. L. Hovey.

•

Grant To K-State Pathologist

Earl D. Hansing, a Kansas State College plant pathologist, has received a $500 grant from the Chipman Chemical Co., Bound Brook, N. J., to study the effect of the company's fungicide on wheat, oats, and sorghum seeds.

In preliminary tests the chemical—commercially known as Chip-

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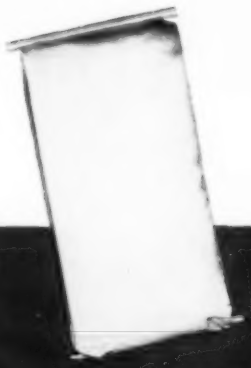

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cote, a methyl mercury nitrile compound — is reported to have given good results in the control of oat smut. Mr. Hansing plans to test the fungicide for control of wheat smut and sorghum smut also.

•

6000 Attend Supply Show

The first of three major regional garden supply trade schools and shows was held in Chicago, Nov. 7 to 9. Nearly 400 dealers attended a two-day short course and 6,000 dealers and distributors attended the three days of exhibitions at the Navy Pier.

Two similar schools and shows are scheduled. The Eastern Management School and Trade Show will be held in the Statler Hilton Hotel in New York on Jan. 30, 31, and Feb. 1. The first Southern School and Show has been scheduled for Miami, Fla., March 5 to 8. The shows are sponsored by the *Garden Supply Merchandiser* magazine.

The short course includes sessions on advertising, sales promotion, store layout, display, and specific problems dealing with buying and selling nursery stock and power equipment.

•

Seven Is Technical Director

Dr. Raymond P. Seven, former director of agricultural research at the Morton Chemical Research Laboratory, Woodstock, Ill., has been appointed technical director of the Panogen Co., a division of Morton Chemical Co., Ringwood, Ill.

In his new capacity, Dr. Seven will devote his time to supervision of product development and field use.

•

Assistant Regional Manager

Claude T. Davis has been appointed assistant to E. L. Stripling Jr., California Spray-Chemical Corp.'s regional manager—Southern. For the time being, Mr. Davis will headquarter at Calspray's Eastern office in Washington, D. C. He has been associated with the company for 12 years.

Dow Sales Supervisors

Two sales office supervisor appointments have been announced in a shift of agricultural chemical sales personnel by the Dow Chemical Co., Midland, Mich.

H. W. Sheldon

H. D. Crain

Hubert D. Crain (right) became the first supervisor of agricultural chemical sales in the Minneapolis office. He has been in a similar post in the firm's St. Louis office. Howard W. Sheldon (left) replaces him at St. Louis. Mr. Crain has been with Dow since 1926 and has been in agricultural chemical sales since 1929.

Mr. Sheldon has been with Dow since 1954. For the past three years he has headed the merchandising section for agricultural chemicals at Dow's home office in Midland.

•

New Geigy Department

Geigy Agricultural Chemicals, a division of Geigy Chemical Corp., Ardsley, N. Y., has formed a sales development department under the direction of J. J. Hood, formerly assistant sales manager. Also assigned to this department are Leo Miles and David Whitlow.

In addition to rendering technical service on all Geigy agricultural chemicals, the department will be responsible for the development of markets for new pesticides and the development of new uses for existing Geigy agricultural chemicals.

•

Stauffer Weed Control Film

A 12-minute, 16 mm. color and sound movie that describes modern weed control practices has been produced by the Stauffer Chemical Co., New York.

The film depicts the most efficient methods of applying both granular and liquid herbicides and illustrates the weed control efficacy of Stauffer's pre-emergence herbicide, Eptam. Prints of the film may be obtained on loan from Stauffer offices in Portland, San Francisco, Los Angeles, Houston, Omaha, Tampa, or New York.

O.K. Sevin For Cotton

Crag Sevin insecticide 50 per cent dust base has been accepted by the United States Department of Agriculture for use in formulating dusts to control cotton insects. Sevin is a product of the Union Carbide Chemicals Co., division of Union Carbide Corp., New York.

The company expects to sell the dust base next year to cotton pesticide formulators who will produce dusts containing five to ten per cent actual Sevin.

•

Farm Equipment Sessions

Special sessions have been announced for farm equipment and farm supply dealers at the University of Illinois Agricultural Industries Forum on Jan. 27-28 at Urbana.

A panel of Illinois agricultural economists will discuss the general market for farm supplies and equipment in Illinois. Other topics to be covered by speakers include trends in livestock and crop production, reasons for farmer's buying decisions, and expected changes in mechanization and automation of field operations and handling of farm products.

•

Fisons Reports Record Year

Sir Clavering Fison, chairman of Fisons Ltd., London, England, in his annual review for the company, said that there has been a substantial increase in the total tonnage of plant food consumed in the United Kingdom and that Fisons' own deliveries have reached the highest level so far recorded.

Increased sales of Fisons' horticultural products were noted; particularly in liquid fertilizers.

•

New Dehydroacetic Acid Use

Aceto Chemical Co., Flushing, N. Y., a supplier of dehydroacetic acid and its salts, has announced that dehydroacetic acid has been shown to inhibit the growth and propagation of a wide range of bacteria and fungi. The company said that a new use for the product is in the treatment of strawberries.

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WACA Meeting March 17

The Spring Meeting of the Western Agricultural Chemicals Association will be held in the Hotel Miramar, Santa Barbara, Calif., on March 17. The morning session is scheduled to be devoted to discussions of the newest products of the basic pesticide producers. Dr. A. M. Boyce, director of the Citrus Experiment Station of the University of California, will be the moderator.

Afternoon speakers will be Dr. R. L. Metcalf, chairman of the Department of Entomology, Citrus Experiment Station, and Dr. George B. Alcorn, director of extension services, U. of California, Berkeley.

•

Named General Manager

Jere Moynihan has been named general manager of the Summers Fertilizer Co.'s operations in the state of Maine and its Canadian division at St. Stephen, New Brunswick. Mr. Moynihan's headquarters are at Sandy Point, Maine.

Mr. Moynihan had been assistant general manager and succeeds Fred L. Litty, who now is vice president and general manager of Northern Chemical Industries at Searsport, Me. The Summers Company, which is headquartered in Baltimore, Md., maintains branches in Maine at Sandy Point, Bangor, Houlton, Mars Hill, and Eastport.

•

Hails Use of Chemicals

A return of $500,000,000 in increased food production is being made annually by Canadian farmers through the use of modern agricultural chemicals, L. M. Godfrey, development and technical service manager of Chipman Chemicals Ltd., Montreal, Canada, claims in the December issue of *Chemicals Outlook*, a publication of Canadian Industries Ltd., Montreal.

Mr. Godfrey writes that weeds, insects, plant diseases and other pests take a yearly toll of two billion dollars and that Canadians are spending approximately five million dollars in the same period on equipment, pesticides, and application. He said that this gives them an average return of one dollar for every cent they spend.

•

Farm Equipment Forum

The University of Illinois Agricultural Industries Forum, Jan. 27 and 28, will include a farm supplies and equipment section featuring talks on the market for farm supplies and equipment in Illinois and the effect agricultural changes have on firms supplying the farm market.

R. J. Mutti, associate professor, agricultural marketing at the university will outline trends in crop and livestock production and E. T. Baughman, assistant vice president of the Federal Reserve Bank of Chicago, will tell how retail dealers may adjust to changes in farmers' credit needs.

Malcolmnson Joins Stauffer

Robert P. Malcolmnson has joined the Stauffer Chemical Co., New York, as technical sales representative for the Agricultural Chemicals Division with headquarters at Holton, Mich.

Formerly associated with the Soil Conservation service, Mr. Malcolmnson also has taught vocational agriculture. In his new position, he will provide technical service to Stauffer's dealers and distributors in the state of Michigan and will maintain liaison with experiment stations.

•

Doran Joins Davidson-Kennedy

Davidson-Kennedy Associates Co., Atlanta, Ga., designers and constructors of chemical and food plants, has appointed Edward Doran as project engineer. Mr. Doran had been with the chemical plants division of the Blaw-Knox Co. where he served as a mechanical equipment selection engineer and then as a project engineer.

Tells Fertilizer Merits

In an address at the National Agricultural Credit Conference sponsored by the American Bankers Association, on Nov. 18 at Omaha, Nebr., William E. McGuirk Jr., president of the Davison Chemical Co., division of W. R. Grace & Co., said that fertilizer use merits the attention of any banker who makes loans which involve the production of crops, dairy production, or livestock.

In his talk, Mr. McGuirk emphasized that fertilizer usage can drastically affect unit costs and profits, that most farmers apply fertilizer at rates far below agricultural experiment station recommendations, and that few farmers look to bankers for help in selecting fertilizers. He said, in addition, that a reasonably accurate scientific determination of proper fertilizer use is available to most farmers and to bankers, also.

Contrary to widespread opinion, he said, it is not difficult for the layman to obtain a reasonably good determination of the proper kinds and types of fertilizer to be used in most cases. Mr. McGuirk pointed out that in most areas of the country, the state colleges of agriculture will provide simple guides to fertilizer usage, which, if followed, would greatly improve fertilizer practices of most farmers.

Discussing soil testing, the speaker called it a remarkable and unique service, a means by which the knowledge of the specialists can be brought to bear on the individual crops and soil of any farmer who requests it. He called it a neatly packaged and readily available management skill. He also pointed out that "since fertilizer can exert such a drastic effect on income, since it frequently is the most profitable single input in the farm enterprise, and since it is not difficult to determine with a reasonable degree of accuracy the most profitable rates of fertilizer usage, fertilizer should not be ignored in any farm plan or farm budget."

Harry W. Schaller, chairman of the Agricultural Commission of the American Bankers Association, presided at the meeting.

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Dow Names Two To Board

Dr. E. O. Barstow of Midland, Mich., and R. L. Curtis of San Francisco, retired last month from the board of directors of the Dow Chemical Co., Midland. They are replaced by Donald K. Ballman, director of sales, and C. B. Branch, manager of the plastics department.

Leland A. Doan, assistant general manager of the Western Division, has replaced Mr. Curtis as general manager of the division. Mr. Curtis retained the post of vice president and will remain as a senior officer on the West Coast.

•

Safety Meeting Feb. 13

The executive committee of the Fertilizer Section, National Safety Council, will hold its winter meeting on February 13, 1959, at the Heart of Atlanta Motel, Atlanta, Ga. This is a change from the previously announced date.

•

Enters Bulk PMA Market

Gallowhur Chemical Co., Ossining, N .Y., now is marketing phenyl mercuric acetate in bulk quantities as a commercial chemical. It is offering PMA as a granular powder in three grades; crude, technical, and purified.

The company, a producer of PMA for the past ten years, previously made the chemical only for its own use. Its main uses are as a component of certain agricultural chemicals, a slimicide in pulp and paper production, as a mildewcide in paints, and a preservative in adhesives.

•

Rename British Group

The Association of British Insecticide Manufacturers has changed its name to; Association of British Manufacturers of Agricultural Chemicals. The group announced that the change was made because the importance of herbicides has made the old name no longer truly descriptive of the type of work carried out by its members.

•

Cyanamid Technical Manager

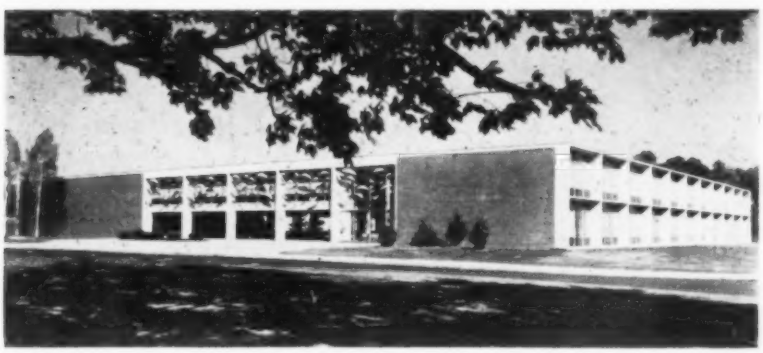
Dr. Leonard G. Tompkins has been named technical manager for the petrochemicals department of the Organic Chemicals Division, American Cyanamid Co., New York. He succeeds Dr. J. C. Pullman, who has been appointed assistant to the division's commercial development manager.

Dr. Tompkins joined Cyanamid's research laboratories in Stamford, Conn. in 1953. Since 1954, he has been associated with the market development department of the company in New York.

New Dorr-Oliver Headquarters Building

Shown above upon completion of landscaping is the new international headquarters of Dorr-Oliver Inc. on Havemeyer Lane in Stamford, Conn. The building, occupied by the company in June of this year, provides 120,000 square feet of office space for approximately 500 persons. The building houses the executive, administrative, and financial staffs; the sales department; and a majority of the firm's technical divisions.

Located on a 20-acre tract, the building is a two-story hollow square surrounding a central landscaped court.



Fertilizer Short Course

The eleventh annual Fertilizer Short Course, being presented under the auspices of the Department of Agronomy, Iowa State College, at Ames, Iowa, will be held January 8. The short course will be preceded by a Fertilizer Salesman's Conference on January 7.

The program for the salesman's meeting includes talks on crop yield potentials for various Iowa soils and soil fundamentals. Speakers for the short course will discuss the fertilizer use outlook for 1959 as influenced by such factors as farmer's knowledge, preceding crops, and moisture probabilities.

•

No Medflies In Florida

Since Nov. 26, 1957, the date field workers of the USDA and the Florida State Plant Board trapped the last Mediterranean fruit fly in the United States, a comprehensive trapping program has failed to trap a single fly. The trapping had been continued to make sure the Medfly did not survive in some isolated section of Florida.

During the period from April, 1956, to November, 1957, the Medfly threatened Florida's $400 million annual fruit and vegetable crops and also, crops throughout the southern half of the country. The pest was eradicated by the aerial application of bait sprays, soil treatment under heavily infested trees, plastic traps, attractants, and various fumigants. By early 1958 when spray operations were discontinued, approximately 800,000 acres had been treated one or more times for a total of seven-million treated acres.

•

Short Course in Farming

The Agricultural Committee of the North Carolina Bankers Association is sponsoring a short course in modern farming to be conducted by the School of Agriculture of North Carolina State College at Raleigh, Feb. 2 to 13. The course is open to young North

Carolina farmers who will receive scholarships from their local banks.

The school will cover such subjects as poultry, marketing, field crops, farm planning, soils and fertilizers, insect and disease control, farm mechanization, horticulture, forestry, and livestock in a two weeks intensive course of lectures, discussions, and tours.

•

Sand Fly Shows Resistance

The salt-marsh sand fly, a biting insect pest of Florida's east coast, is showing resistance to several insecticides that once provided excellent control, U. S. Department of Agriculture entomologists reported.

Laboratory tests indicate 100-fold resistance to insecticides like dieldrin, heptachlor, chlordane, and lindane, and about 10-fold resistance to endrin, by sandfly larvae obtained from a marsh that had been treated with some of these insecticides several times over a four-year period. Larvae from an untreated marsh were normally susceptible. The tests revealed no resistance by larvae from either the treated or the untreated marshes to DDT, malathion, parathion, and Bayer 21/199. These insecticides have not been especially effective in field tests on the sand fly larvae, the USDA reports.

•

Amino Triazole Film

The American Cyanamid Co., New York, has released a color-film entitled "Roots and All" that describes the control of weeds with amino triazole, a systemic herbicide.

The 16-minute story takes place in the East, Midwest, and California and shows how the new chemical offers a single-application approach to weed control. Amino triazole is said to be effective against perennial weeds like Canada thistle, cattails, and quack grass.

The film is available for showings at weed control meetings for agricultural groups from the company's Agricultural Division.

Crown Shifts Two Managers

The Crown Zellerbach Corp., San Francisco, has appointed Neil McClarnan (left) as northern regional sales manager for the firm's Multiwall Bag Sales

Division. Headquartered in Chicago, Mr. McClarnan will direct Crown Multiwall sales staff in Minneapolis, Columbus, St. Louis, Kansas City, and New York.

Mr. McClarnan replaces Fred Bostock (right) who has been transferred to the company's San Francisco headquarters as western regional sales manager with responsibility for coordination of Crown Multiwall sales offices in Seattle, Portland, Los Angeles, Salt Lake City, and Denver.

•

Awarded Campbell Fellowship

Anthony DiEdwardo, a graduate student in the Department of Entomology, College of Agriculture, Rutgers University, New Brunswick, N. J., has been awarded the Campbell Fellowship in the plant sciences. The fellowship recently was established by the Campbell Soup Co.

Mr. DiEdwardo has been employed by E. F. Drew & Co., Boonton, N. J.; Flintkote Research Laboratories, Cedar Knolls, N. J.; and the Allied Chemical and Dye Co., Morristown, N. J. He was graduated from the Rutgers College of Agriculture in 1957 with a B.S. degree in the plant sciences and currently is studying the biology and control of plant parasitic nematodes.

•

Six Win Hercules Grants

The Hercules Powder Co., Wilmington, Del., has awarded six $400 college scholarships in the National 4-H Entomology Awards Program. The awards were presented at the 4-H Club Congress in Chicago last month.

Scholarship winners are Meredith Herron of Attalla, Ala.; Herman Orcutt of Phoenix, Ariz.; William J. Platt III of Gainesville, Fla.; Paul Hayes of Waldron, Ind.; William Davis of Newton Junction, N. H.; and Anthony Nitko of Jamesburg, N. J. Hercules has sponsored the awards for the past seven years.

•

To Study Tree Nutrition

The Tennessee Valley Authority has announced that it has intensified its basic research studies on "tree nutrition," the objectives of which are to determine under what conditions fertilization of forest trees is economical, what fertilizers are best to use, and how to apply them.

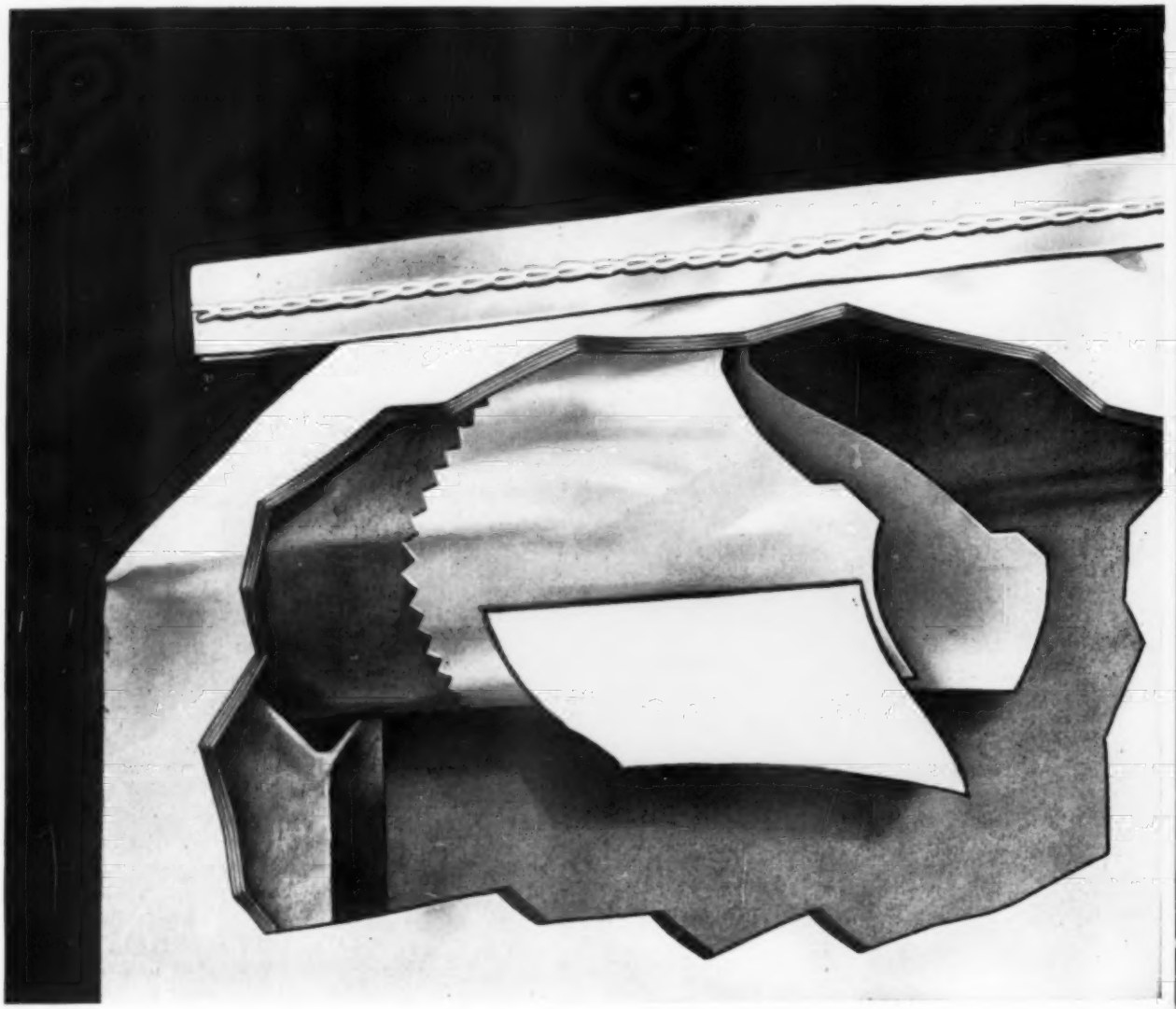
The decision to move forward into this field came after an analysis of preliminary tests showed encouraging but not conclusive results. Richard Klibourne, director of TVA's Forestry Relations Division, said that the preliminary tests show questionable benefits from fertilizing pines at time of planting. In four out of five black locust planting tests, however, a phosphate application improved growth for as long as five years, Mr. Klibourne said. The principal areas of investigation by the TVA will include producing seedlings in nurseries, establishing new stands by planting, producing seed in orchards or other seed production areas, producing wood, and controlling insects and disease.

•

TV Group Cites Wilson

The National Association of Television and Radio Farm Directors have conferred a "Meritorious Service Award" on Louis H. Wilson, secretary and director of information for the National Plant Food Institute, Washington, D. C. The award was made last month at the association's 15th annual convention in Chicago.

The award, the second to be presented in the history of the organization, consisted of an engraved plaque. It was presented by Robert C. Miller, director of the farm department of station WLW in Cincinnati and president of the association.



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Results Obtained with New Pesticides Highlight Reports at Oregon Meeting

APPARENTLY increasing rapidity with which insect pests as well as fungi are developing resistance to chemical controls, as well as the complexity of mixtures orchardists are using in combatting these pests are presenting bigger problems to the scientists. This was emphasized in numerous talks during the 73rd annual meeting of the Oregon State Horticultural Society late in November.

Best-attended of any of yearly conferences of the organization at Oregon State College, the two-day gathering consisted of four simultaneous sessions divided according to the major interests of the producers. Rootstocks used for the orchard trees as well as the physical condition of the plantings may account for variations in control obtained with the same pesticide in different trials, Louis C. Gentner, entomologist at the Southern Oregon Experiment Station, Medford, indicated as he cited instances of resistance which has been developing in a variety of species to some of the newer agricultural chemicals.

Good control of the two-spotted mite complex – which had developed resistance to all phosphorus sprays is being obtained with Kelthane and Tedion. Release for the former has been obtained from the Food and Drug administration for commercial use. The latter will be included in next year's list of suggested sprays if similar approval of label is obtained, he commented.

Unforeseen troubles which crop up were typified by chlorobenzilate, which had passed four years of tests without injury to foliage or fruit, then this year (for causes not entirely clear) caused fruit-spotting in some instances, but not under all conditions, he went on.

Tests on 44 fungicides and mixtures were conducted during the past season in some experiments in the Willamette valley, reported Norman Dobie, plant pathologist at Oregon State College. New materials to be added to the recommendations as a result of these tests are: TAG (at the rate of 1½ pints to 100 gallons of water) for peach leaf curl; Maneb (2 pounds in 100 gallons of water) for brown rot blossom blight on cherries, and Cyprex (1 pound per 100) for apple scab. Cyprex will be included if and when Food and Drug Administration clearance is obtained, Dobie added.

Four materials look very promising for control of coryneum blight in fall applications, Dobie added. Ziram at 2 pounds per 100; OM 11 (an experimental material) at 1 pound to the 100; Cyprex at 2 pounds per 100, and Phaltan at 3 pounds per 100 reduced killing of fruiting wood almost to zero in his tests. In addition, the sprays were effective in controlling fruit infection.

During tests this year Phygon ranked first in brown rot blossom blight control in his cherry test plots, Dobie commented.

Scientists may be on something of a treadmill in combatting various plant ailments, Dr. J. R. Magness, chief of the fruit and nut crops research branch of the Agricultural Research Service, U.S.D.A., Beltsville, Md., implied in a luncheon address. Strawberry plant breeders have developed varieties resistant to red stele disease that attacks roots of the strawberry plants.

Now the organism responsible for red stele has developed at least five different strains recognized by the scientists. As a consequence, strawberry plant breeders may be forced to engage in a race to produce strawberry varieties resistant against the red stele organism just as specialists in grain breeding have tried to combat certain fungus ailments.

Brown rot blossom blight of cherries was controlled as effectively by materials applied with a concentrate sprayer as by a handgun on some occasions, Ian C. MacSwan, Oregon State College plant pathologist, reported. TAG was the material giving the best results in the tests made. Ziram and ferbam resulted in 19.5% and 23.6% infection respectively, compared to 12% for TAG; 34% for wettable sulphur, and 50% for unsprayed trees. Others ranged between.

Petal burning and some other spray injury appeared when wettable sulphur and CSM (Colloidal Spray Modifier) was applied at more than the recommended rate of the surfactant. Used at the recommended rate of 2 ounces per 100 gallons – instead of 1 quart of CSM–petal burning was reduced to the same amount as that following sulphur dusting in an adjoining orchard.

Production from the TAG plots was from 300 to 500 pounds of cherries per tree, contrasted with 125 to 150 pounds in the other test plots of two acres each. More than five extra tons of cherries were obtained through the use of TAG, James S. Smart, the grower in whose orchards the tests were made, reported. An extra five tons of cherries from four acres represents a return of approximately $1500 for a cost of about $64 for materials, it was pointed out.

Sprays were applied in the popcorn, full bloom and petal fall stages.

Karathane and Karathane combined with Phaltan provided a significant reduction in powdery mildew in red raspberry test plots early in the season, Edward K. Vaughan, Oregon State College plant pathologist, reported to the small fruit section of the convention. Phaltan was added to some

(*Continued on Page* 117)

Arcadian® News

Volume 4 | For Manufacturers of Mixed Fertilizers | Number 1

Technical Tips for Better Ammoniation

ADVANTAGES OF SULFURIC ACID IN MAKING MIXED FERTILIZERS

FUNCTIONS of SULFURIC ACID

SULFURIC ACID has three important functions in the manufacture of mixed fertilizers:

1. Reacts "excess" ammonia when the formula contains more ammonia than can be reacted with superphosphate.
2. Increases the heat of the mass for better granulation.
3. Adds sulfur to the mixed fertilizer. Most leading crops are big users of sulfur. *(See article on next page.)*

Today's higher-analysis mixed fertilizers require correspondingly higher proportions of nitrogen solutions in formulation. As a result, the superphosphate often cannot react all of the ammonia contained in nitrogen solutions, and the producer has an "excess" ammonia problem to solve.

Sulfuric acid is the answer. This potent chemical reacts very efficiently with the "excess" ammonia, delivering the maximum ammoniation necessary to produce high nitrogen content. Consult the following table to see how much sulfuric acid to use for each pound of "excess" ammonia in the formula.

SULFURIC ACID

Grade	Per Cent Acid	Per Cent Water	Pounds Reacting With 1 lb. Ammonia
60° BE	77.67	22.33	3.58
66° BE	93.19	6.81	3.09
	100.00	0	2.88*

*(For comparison—not used.)

Even before "excess" ammonia became a common problem, many fertilizer producers were using sulfuric acid for its great aid to granulation. Properly used, sulfuric acid raises the heat of the mass, yielding a more desirable liquid phase or plasticity. This, in turn, permits better granulation at lower initial water content. The following table points up the spectacular heat generation properties of sulfuric acid as compared with other materials.

Heat Generated by Reacting Ammonia

Material	B.T.U's of Heat Per Pound of Ammonia, Approximately
Superphosphate 20% P_2O_5	1460
Triple Superphosphate	1540
Phosphoric Acid	1900
Sulfuric Acid	2940

The specific heat of fertilizer (B.T.U.'s required to raise one pound 1° F) is generally placed at about .25. This means that 500 B.T.U.'s are required to raise (or lower) a ton of fertilizer 1° F. Now the evaporation of one pound of water in the formulation process absorbs about 1040 B.T.U.'s, which would cool a ton of fertilizer about 2° F.

Above 180° F, the evaporation of water is quite rapid. Of course, the condensing of one pound of steam dissipates the aforementioned 1040 B.T.U.'s and would theoretically raise the temperature of the fertilizer about 2° F. However, the heat losses from radiation are considerable at the higher operating temperatures, particularly as little, if any, effort is directed toward conserving heat. It is difficult to compute heat losses from radiation without specific data on the equipment used.

The combined loss of heat from the evaporation of water, radiation and heating the surrounding air is so great that mass temperatures above 220° F are attained only at very high heat input. In most fertilizer operations, equilibrium seems to be reached at 230° F or 240° F. If the temperature in the ammoniating equipment exceeds these levels the operation is suspect. There is probably too little water present for reasonable safety, or some other control has failed, making it possible for unwelcome reactions such as fires, fumes or explosions to occur.

How to Use Sulfuric Acid

It is normal good practice to introduce and mix the nitrogen solution as uniformly as possible with the superphosphate. This assures maximum ammoniation and produces good physical condition without fumes or loss of ammonia. Careful, uniform mixing is also necessary when adding sulfuric acid to the mass. And it is most important that sulfuric acid be added *before* the ammonia.

In its simplest form, the introduction of sulfuric acid should be through a spray pipe (acid distributor) drilled somewhat like the ammoniating pipe. In the batch rotary mixer this calls for a rather slow

distribution of acid; but not as slowly as when distributing ammonia at higher quantities in superphosphates, for entry of the acid into the dry ingredients is essentially a *physical* act. Entry of ammonia on the other hand, is a *chemical* action—with ammonia take-up in the superphosphate getting slower and slower as saturation is approached. Sulfuric acid reacts very fast with ammonia at all stages of the mixing process.

In continuous ammoniation operation, the acid should be added continuously through numerous small holes or slots in distribution pipes running virtually the full length of the mixer. Many producers add the acid below the surface of the mass near the ammoniating distribution pipe.

The important thing is to avoid any heavy concentration of acid in the mass. And, of course, sulfuric acid and nitrogen solution should *never* be distributed through the same pipe, as serious accidents can occur.

Sulfuric Acid and Safety

There has been much concern (and rightly so) over safety in the use of sulfuric acid and ammoniating solutions. The handling and proportioning of the acid itself, as well as its distribution in the fertilizer mass demands careful procedures. It is extremely destructive to human tissues. Every precaution must be taken to prevent contact with any part of the body. Adequate safety equipment in the plant, and protective clothing, gloves, face masks, and goggles are absolutely necessary.

A potential hazard is the presence of potassium chloride in the fertilizer mass. Sulfuric acid reacts with this potassium chloride during the complex actions in the mass to form hydrochloride acid, a strong oxidizing agent. Some operators have greatly reduced this reaction by delaying the introduction of the potassium chloride until after the sulfuric acid has been neutralized by the ammonia.

Of course, sulfuric acid and nitrogen solution should never be added to each other when there are *no* dry ingredients in the mixer. This could result in a bad flash fire, or even a mild explosion. Actually, this same condition sometimes occurs in continuous mixers where the mass does not rotate or tumble as intended, but merely "rocks" as one lump. Here, too, flash fires are a hazard. For, in effect, the acid and nitrogen solution are being mixed together, with virtually no intervening regulating or restraining action.

Safe Equipment

Accidents can stem from poor distribution of nitrogen solution or acid because of worn or corroded distributor pipes. Then too, some distributor pipes are of such questionable design as to give dangerous delivery even when new.

Centrifugal pumps with emergency shut-down switches (preferably several), placed in quickly accessible, safe locations, are recommended rather than air pressure for moving sulfuric acid. Should a pipe or valve fail with acid under air pressure, a great amount of acid could be sprayed around before the flow is stopped.

For batch operations a simple, elevated measuring tank using gravity flow to the mixer is advised. Gauge glasses should be avoided. This can be done by having the liquid level relayed through a stainless steel cable and pulleys to a vertical board and marker. The measuring tank should be large enough to accommodate as many as 10 or 12 batches to minimize the number of times required for filling. An overflow pipe returning from the measuring tank to the storage tank must have a capacity greatly exceeding that of the pump to avoid overflow. This overflow pipe should be connected well below the top of the measuring tank. A visual and aural alarm should be part of the tank equipment, to warn the operator when the acid level has exceeded the safe point.

Provisions should be made against permitting sulfuric acid to be confined in ordinary steel between two tightly-closed valves, or any arrangement that permits excess pressures. Hydrogen is released by the action of sulfuric acid on steel and excessive pressures can develop. Also, hydrogen itself is a distinct fire and explosion hazard, hence the restraint against smoking, fires, etc.

Sulfuric Acid Pays Off

It is well worth the effort to learn how to use sulfuric acid correctly and safely in formulations. More and more producers are using it successfully in increasingly greater amounts per ton of fertilizer. You, too, will be rewarded by turning out the fine quality, high-analysis fertilizers in demand today. Check your sulfuric acid supplier. Most suppliers furnish, on request, detailed literature on the properties, use and safe handling of their product. And, of course, our technical service staff is always ready to help with specific formulation problems. Write Technical Service, Nitrogen Division, Allied Chemical, 40 Rector Street, New York 6, N. Y.

BENEFITS of SULFUR in Crop Production

Sulfur is more deficient in soils than phosphorus, according to a recent general soil survey. In many important growing areas across the country, crop response to sulfur has been noted.

The Eastern Seaboard states, particularly Florida, Georgia and Alabama, have considerable soil that is deficient in sulfur. The same is true of Minnesota and Nebraska, with some neighboring Midwestern states also indicating the development of sulfur deficiencies. Research in most states west of the Rockies reveals crop response to sulfur.

To date, however, sulfur requirements of plants have been ignored to a large extent because most fertilizers have carried substantial amounts of sulfur along with nitrogen, phosphorus and potash.

Unfortunately, fertilizers which are sulfur-free now are increasing in use, although the value of sulfur in mixed fertilizers is abundantly clear. Land that is fertilized with nitrogen, phosphorus and potash, but not sulfur, will undoubtedly show sulfur deficiencies.

There is a great need for high-analysis, high-nitrogen mixed fertilizers to provide crops with vital growing power. With continued cultivation, nitrogen deficiencies have developed, and response to nitrogen fertilization can be demonstrated in almost any area of the country. In manufacturing high-analysis mixed fertilizers for farmers, fertilizer manufacturers should make certain that the mixed goods contain adequate sulfur.

Organic matter is the chief natural source of both nitrogen and sulfur in the soil. With no nitrogen fertilization, the sulfur released by decomposition of organic matter would be adequate for crop needs. However, adequate nitrogen fertilization is necessary, and there is not enough decomposition of organic matter in the soil to provide sulfur for crop needs. It has been noted that sulfur response in non-legume crops can be expected to occur most commonly at high levels of nitrogen fertilization.

Sulfur Leaches Fast

Although sulfur is available to plants as sulfate, studies show sulfate can be easily leached out of many soils. Surface soils in the Southeast, for example, are badly leached. This is particularly true of the light soils of the Coastal Plain. Shallow-rooted crops and seedling plants

grown there are often deficient in sulfur.

Bacteria in the soil use sulfur in much the same manner that they use nitrogen. If a crop residue that is low in nitrogen but high in energy, such as corn stalks, is plowed under, the bacteria use the available nitrogen before the next crop can get it, and a nitrogen deficiency develops. The same effect has been noted in sulfur experiments.

All of this builds up an impressive case for adding an adequate amount of sulfur to high-analysis mixed fertilizers. The following table shows the sulfur contained in commonly-used fertilizers made from ammoniated superphosphate.

Per Cent of Sulfur in Various Fertilizers Made from Ammoniated Superphosphate

Fertilizer	Sulfur
16-8-8	8.5%
15-10-10	7.6%
8-8-8	6.2%
12-12-12	7.0%
6-12-12	7.3%
4-16-16	6.9%
5-20-20	4.0%
6-24-24	less than 1%
13-39-0	less than 1%

Sulfur is classed as a secondary element. This implies that plants use less sulfur than nitrogen, phosphorus or potash. However, this is not necessarily true. On an elemental basis, the corn plant actually uses as much sulfur as it does phosphorus.

Elemental Composition of Corn (Grown at Manhattan, Kansas)

	Leaves	Stem	Grain	Root	Cob
Nitrogen	1.30%	0.84%	2.15%	1.27%	1.38%
Phosphorus	0.21%	0.09%	0.34%	0.12%	0.94%
Potassium	1.48%	1.23%	0.42%	0.48%	0.46%
Sulfur	0.24%	0.16%	0.14%	0.25%	0.02%

A 100-bushel corn crop requires about 160 pounds of nitrogen, 25 pounds of elemental phosphorus, 100 pounds of potassium and 25 pounds of sulfur.

The role of sulfur in growing good corn provides a prime example of why it is important to use an adequate amount of this important ingredient in manufacturing mixed fertilizers.

Corn is the biggest single market for fertilizer in this country. To grow big yields of corn, it is necessary to use a lot of nitrogen. Therefore, a high-analysis, high-nitrogen mixed fertilizer, such as 2-1-1-S, is ideal for corn. It is obvious that a high-nitrogen combination is needed, and that adequate sulfur must also be included in high-analysis fertilizer.

ARCADIAN® Nitrogen Solutions make it easy to formulate the right kind of high-analysis mixed fertilizer in almost any plant. In making these fertilizers, remember that ammoniated superphosphate is a rich source of sulfur. When you ammoniate normal superphosphate as a base for mixed fertilizers, you are giving farmers a big extra value in free sulfur and calcium essential to profitable crop production on many soils.

TONNAGE OPPORTUNITY:

BULK FERTILIZER BULKS UP SALES

It will pay you to take a long look at bulk fertilizers. This method of handling automatically favors heavier application per acre and greater total sales. And the larger farmers who are the best fertilizer customers often prefer the bulk system for a large part of their tonnage. Where bulk service is good, many farmers use it even where the products offered in bulk are inferior to those offered in bags.

Save Time and Labor

Handling fertilizers in bulk provides definite savings in time and labor for farmer, dealer and manufacturer. Where bulk fertilizers are handled mechanically, farmers are less apt to scrimp on recommended application rates per acre.

Many bulk truck and trailer units now on the market do an excellent job of spreading fertilizer for plow-down or top-dressing. Self-unloading feed and grain wagons are being designed for the additional job of handling fertilizer. Portable bins, hauled on trucks or wagons, are being used for fertilizer as well as for crops. New fertilizer broadcasting equipment is being designed with larger hoppers, and many farmers and dealers are also improvising bulk fertilizer equipment. New planters and drills come equipped with bigger hoppers located for convenient filling from bulk as well as from bags. Hauling equipment is also being adapted for easy mechanical unloading into fertilizer hoppers on planters.

Strengthen Distribution

The large investment needed for specialized bulk equipment helps to discourage the part-time dealer and the in-and-out price opportunist. Dealers who have invested in fertilizer-handling equipment must concentrate on doing a better job of merchandising to protect this investment. They are more inclined to stay active every year, to develop stronger and more stable markets. The natural result is a stronger distribution system built around better service.

The need for custom application of much of the bulk fertilizer tonnage is no real handicap to bigger sales. Efficient, large-scale custom equipment enables good operators to apply fertilizer at low cost per ton. The farmer is often happy to be relieved of the job. Many a custom operator finds that his close contact with the farmer helps him do a better all-around job of sales and service.

Equipment Builds Sales

Fertilizer manufacturers can benefit greatly by working with equipment suppliers on improving bulk handling systems. Fertilizer dealers can help by working closely with farm equipment retailers to stimulate the sale of suitable equipment to farmers. It also pays to encourage custom applicators and dealers to get efficient new large-scale machinery.

Dealer ownership of bulk storage and handling equipment helps to reduce the fertilizer manufacturer's perennial problem of off-season storage and peak-season service. Some manufacturers have profitably increased their sales by supplying or subsidizing bulk storage and handling systems for dealers.

It will pay you to look into bulk handling of fertilizers as a method of increasing business and profits, and as a means of building a more stable distribution system with valuable long-term benefits. Before the spring rush hits, be ready for bulk business.

Nitrogen Helps Grass Exceed Alfalfa in TDN and Protein

Brome and orchard grasses, heavily fertilized with nitrogen, produced more total digestible nutrients and more digestible protein than alfalfa, in tests at the New Jersey Dairy Research Farm. These continuing studies accurately determine yield of feed per acre and digestibility of roughage fed to dairy cows.

Orchard and brome grass, fertilized with 200 pounds of nitrogen per acre, produced 1,947 pounds and 2,118 pounds of TDN per acre, respectively. Alfalfa fertilized with 600 pounds of 0-10-20 per acre produced 1,242 pounds of total digestible nutrients per acre. The fertilized grass produced about 50% more digestible protein per acre than the alfalfa. Fat and fiber in the fertilized grass was also much more digestible than in the alfalfa.

HERE'S THE BIG LINE OF Arcadian® NITROGEN SOLUTIONS

When you purchase your nitrogen requirements from Nitrogen Division, Allied Chemical, you have many different nitrogen solutions from which to select those best suited to your ammoniation methods and equipment. You are served by America's leading producer of the most complete line of nitrogen products on the market. You get formulation assistance and technical help on manufacturing problems from the Nitrogen Division technical service staff. You benefit from millions of tons of nitrogen experience and the enterprising research that originated and developed nitrogen solutions.

	CHEMICAL COMPOSITION %						PHYSICAL PROPERTIES		
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60°F	Approx. Vap. Press. at 104°F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®									
2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
URANA®									
6	42.0	19.5	66.3	6.0	8.2	9.3	1.178	10	34
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	- 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
15	44.0	28.0	40.0	15.0	17.0	12.7	1.052	29	1
U-A-S®									
A	45.4	36.8	—	32.5	30.7	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	13.5	0.978	48	46
Anhydrous Ammonia	82.2	99.9	—	—	—	24.3	0.618	211	-108

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Spencer "Ura-Greeen" Show

Nitrogen solutions for direct application have a most promising future, according to agronomists at the Spencer Chemical Co.'s "Ura-Greeen" show held in Henderson, Ky., Dec. 11 and 12.

In a seminar at the show, Brown Beasley, Spencer agronomist, and Nelson Abell, Monroe, La., fertilizer mixer, discussed nitrogen solutions. Mr. Beasley reviewed the chemistry of nitrogen solutions and compared the yield results from experimental plots which used several different forms of nitrogen. In nearly all cases, he said that the nitrogen gave equal, if not superior, yields. The 60 liquid fertilizer mixers at the show were taken on a tour of Spencer's Henderson Works and the new urea production facilities there.

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Eastman Names McNeeley

Harry D. McNeeley, vice president of Tennessee Eastman Co., has been named executive vice president of that Kodak division. Mr. McNeeley also was named a vice president of three Eastman subsidiaries which have headquarters in Kingsport, Tenn.: Eastman Chemical Products, Inc.; Holston Defense Corp.; and Holston Trading Corp.

•

Hahn Sprayer Clinic

Hahn, Inc., Evansville, Ind., conducted a three-day Distributor Sprayer Clinic in Evansville that was attended by distributors of Hahn Hi-Boy Sprayers from every part of the U. S.

G. E. Betulius, sales manager of the Hahn Sprayer Division, reported a 21 per cent increase of Hahn sprayer sales in 1958 and said that the company expects to exceed this by 35 per cent in 1959. The theme of the meeting was "Hit a New High with Hi-Boy."

•

New Spencer Herbicide

Otto L. Hoffman, biological research group leader for Spencer Chemical Co., Kansas City, Mo., spoke at the North Central Weed Conference in Cincinnati, Dec. 3, and said that laboratory and limited field tests of "S-847" have given favorable results in the control of wild oats.

"S-847" chemically is known as 4-chloro - 2 - butynyl N - (3 - chlorophenyl) carbamate. It is a post-emergence herbicide.

Most crops grown in areas where wild oats are a problem, Dr. Hoffman said, are represented by varieties which will tolerate dosages of "S-847" that are toxic to wild oats. He reported that wheat, barley, flax, peas, and sugar beets have been treated successfully.

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Sanders Heads ACS Division

M. D. Sanders, director of research and development of Swift & Co.'s agricultural chemical division, Chicago, has been elected chairman of the American Chemical Society's division of Fertilizer and Soil Chemistry for 1959. He succeeds Dr. Kenneth G. Clark of the U.S.D.A., Beltsville, Md.

Travis P. Hignett of the TVA, Wilson Dam, Ala., was chosen chairman-elect of the ACS division. John O. Hardesty, also of the U.S.D.A., is the secretary-treasurer.

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Maryland Pesticides Conf.

The 5th annual Agricultural Pesticides Conference sponsored by the University of Maryland's College of Agriculture will be held in February.

The first meeting will be held Feb. 13 at the Salisbury State Teachers College. Meetings also are scheduled for Feb. 16 in the Episcopal Parish Hall, La Plata, and Feb. 18 in the Francis Scott Key Hotel, Frederick.

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Pacific Coast Adds To Sales

The Pacific Coast Borax Company division of the United States Borax & Chemical Corp., Los Angeles, has named Don H. Gravlee to its agricultural sales department.

Mr. Gravlee will cover the southeastern territory with headquarters in Atlanta, Ga.

Stern Heads Research

Dr. David R. Stern has been named manager of research at the Los Angeles Plant of the American Potash & Chemical Corp.

Dr. Stern joined the reseach staff of the Western Electrical Co. at Culver City, Calif., in 1951 and, when that company was acquired by American Potash in 1955, joined the parent company's main research laboratory in Whittier, Calif.

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To Open Charlotte Office

The Dow Chemical Co., Midland, Mich., will open a sales office in Charlotte, N. C., February 2. The new office, the firm's 19th in cities throughout the U. S., will be located at 504 Wachovia Bank Building.

T. H. Caldwell, Jr., will be manager of the office. He had been manager of automotive chemical sales. The Charlotte office territory includes North Carolina, South Carolina, and portions of Virginia and Tennessee.

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MSA Names Swanson

Robert W. Swanson has been named sales engineer for the Detroit territory of the recently expanded Technical Products Division of the Mine Safety Appliances Co., Pittsburgh, Pa.

Mr. Swanson has been with the company since 1954.

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Pesticide Residues Panel

At the September, 1959, meeting of the American Chemical Society in Atlantic City, N. J., a symposium will be held on "Pesticide Chemical Residues in Milk and Meat." The symposium will be sponsored by the Pesticides subdivision of the Division of Agricultural and Food Chemistry (A.C.S.).

Dr. J. F. Treon, Atlas Powder Co., Wilmington, Del., is organizing the symposium. He has announced that abstracts of papers should be submitted by June 15 and the complete papers should be in one month prior to the meeting.

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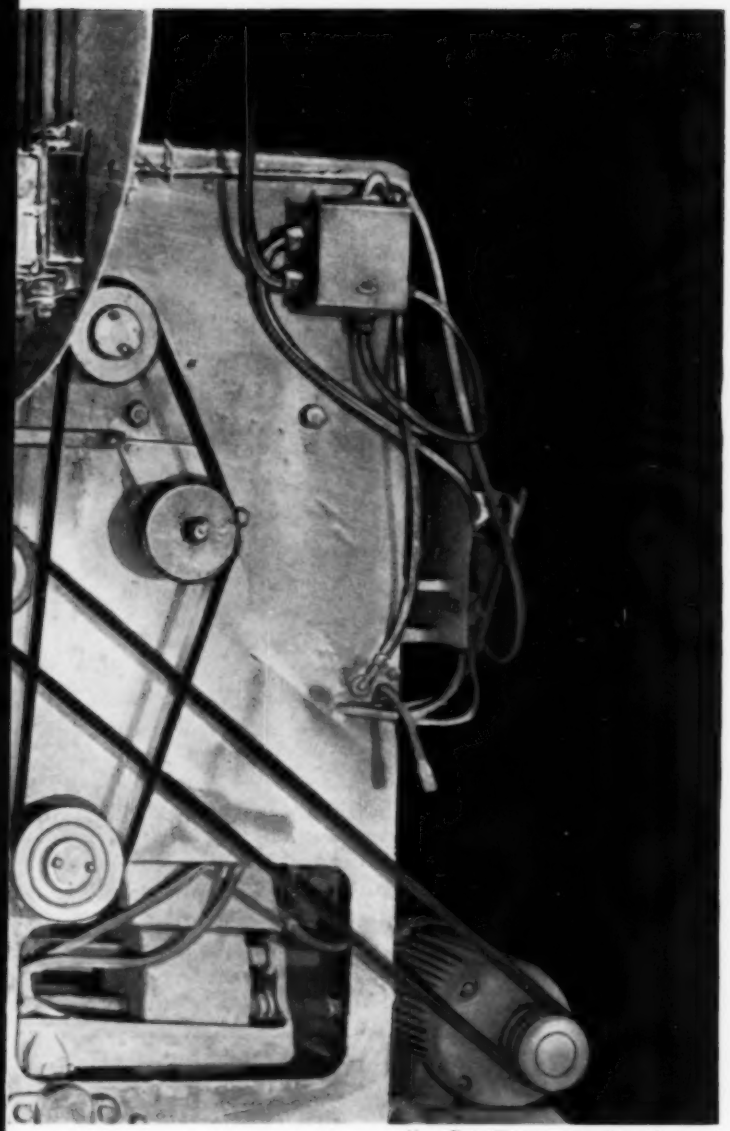

Note: Photo illustrates unit with guard removed

LATEST and most efficient valve bag packer for the fertilizer industry, the St. Regis 161FB Valve Bag Packer packs as high as 22 bags per minute with almost-automatic precision of weight control and bag cleanliness.

DESIGN that helps in the merchandising of your product is a specialty of the St. Regis Pensacola, Florida, plant. Shown here is portion of the bag design room where selling designs are developed.

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That's only the beginning! St. Regis bag packing machinery brings lower cost per ton, too. The 161FB Valve Bag Packer, for example, packs as high as 22 bags per minute—can pack from 25 lb. to 100 lb. bags. It fills, weighs and discharges bags automatically. All the operator does is place empty bags on the filling tubes. A built-in settler compacts the bag contents during filling to permit use of smaller bag sizes.

A St. Regis Sales Engineer can examine your packing method, analyze your present bags and filling equipment—and show you how to make appreciable reductions in your cost per ton figures. Why not call him in today? See for yourself what St. Regis offers. Better bags. Better ways to fill them. Printed bag designs that help merchandise your product at the point of sale. If you pack in open mouth bags, ask for his help there.

In multiwall packaging, St. Regis means lower cost per ton.

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To Test Thuricide

Thuricide, the first of what may be a series of microbial insecticides, will be field tested this season by Bioferm Corp., Wasco, Calif.

The firm already has established facilities to produce the "living insecticide" on a large scale. In addition, it has effected an arrangement with the Stauffer Chemical Co., New York, whereby the technical staffs of the two firms will jointly continue the development of the product.

Thuricide is composed of live spores of the microorganism *Bacillus thuringiensis*. Recently, the U. S. Food and Drug Administration granted a temporary exemption from tolerance for Thuricide for application on a wide range of food and storage crops.

•

To Manufacture Fertilizer

The Husky Oil Co., Cody, Wyo., plans to manufacture phosphate fertilizer in 1959. The company is said to have acquired sufficient high-concentrate phosphate reserves in Idaho to supply a plant using 150,000 tons per year for more than 70 years.

•

Black Leaf Chicago Office

The Black Leaf Products Corp., Lousiville, Ky., has acquired 16,000 square feet at 6143 N. Broadway for a Chicago warehouse and office.

•

Joins Stauffer Sales

J. Basil Bowers has joined the sales development department of the Agricultural Chemicals Division, Stauffer Chemical Co., New York. He had been head of the plant pathology department at Stauffer's agricultural research laboratories in Mountain View, Calif.

Mr. Bowers joined Stauffer in 1952.

•

IMC Names Three

The International Minerals & Chemical Corp., Skokie, Ill., has appointed two directors and a chemical research manager in its new research, engineering, and development division.

H. Turner Loehr was named director of engineering and Lawrence A. Roe is director of development. Walter Lincoln Hardy is manager of chemical research.

Directors of other departments in the new division are Dr. M. B. Gillis, research, and Dr. F. C. Kruger, mining and exploration.

•

Shade Tree Conference

The 14th annual meeting of the Midwestern Chapter of the National Shade Tree Conference will be held Feb. 18, 19, and 20 in the LaSalle Hotel, Chicago.

•

Joins Columbia-Southern

William C. McConnell has joined the agricultural chemical sales department of the Columbia-Southern Chemical Corp., Pittsburgh, Pa.

During the past six years, Mr. McConnell has served as plant manager for the Woolfolk Chemical Works of Fort Valley, Ga.

•

To Represent Sole Corp.

The Sole Chemical Corp. Chicago, has appointed Monroe-Danford & Co., Weehawken, N. J., as technical representatives in New York State and upper New Jersey.

•

Du Pont Adopts Trademarks

Two new trademarks have been adopted by E. I. du Pont de Nemours & Co., Wilmington, Del., for neburon and fenuron. Changes in the use of the trademarks "Karmex" and "Telvar" for the compounds, diuron and monuron, also were announced.

The new trademark "Kloben" now identifies neburon weed killers (formerly known as Karmex N), and the trademark "Dybar" now applies to fenuron weed and brush killers. (Formerly known as Karmex FP).

"Telvar" now will identify only products based on monuron, and "Karmex" identifies only products based on diuron.

CSMA Discusses New Pesticides

A panel discussion of new pesticide products highlighted the program of the Insecticide Division of the Chemical Specialties Manufacturers Association which held its 45th annual meeting at the Hotel Commodore in New York City, December 8-10. S. A. Hall, USDA, Beltsville, Md., reported on "Barthrin," a new insecticide of the allethrin type, developed by W. F. Barthel and co-workers of the USDA laboratories in Beltsville, Md. Tests show the product to be less toxic than pyrethrins or allethrin.

D. Baldwin, Dow Chemical Co., reported on the systemic insecticide ET-57, offered for control of cattle grubs. Z. Z. Dworkin, Glenn Chemical Co., discussed the performance of the insect repellent "Tabatrex"; and J. B. Moore, McLaughlin Gormley King Co., reviewed three new MGK repellents.

•

Cattle Spray Sales Up

Sales of cattle spray products during the 1958 summer season were ahead of previous years, according to a survey conducted by the Glenn Chemical Co., Chicago.

The survey was made of 58 formulators whose cattle sprays contained Tabatrex insect repellent. Eleven of those had not previously formulated a cattle spray. Of the remaining 47, a total of 41 reported increased sales, three reported "about the same," and three stated that their volume was somewhat lower than in the previous year.

•

2nd Stretchable Paper Machine

The West Virginia Pulp and Paper Co., New York, plans to equip a second paper machine for producing its Clupak stretchable paper. The move will increase the total capacity for this product to more than 150,000 tons annually.

The company began manufacturing Clupak paper early in 1958 at its Charleston, S. C., mill. The second unit also will be installed in that mill.

CFA Reviews Trends in Fertilizer Distribution

(Part 2)

W. L. Dixon Jr., Vice President and General Manager of Pacific Guano Company, discussed "Trends in Granular Material."

Under granular materials, he said we should consider pelleted material such as 16-20-0, a prilled material similar to ammonium nitrate or urea, sulphate which is the result of compaction, and ammonium nitrate, the result of breaking up a malt.

All of these materials have come into prominence due to the demand on the part of the farmer consumer for a higher quality material. He wanted a material of uniform size, with no dust, that he could apply evenly, and that he could place easily and store with a minimum of setting or caking. Some of the corrollaries of producing these materials of superior physical condition have been quite interesting in that they have enabled lower production costs to be secured by using more basic raw materials with newly developed techniques, and also, by having homogeneous granules or pellets, the dangers of segregation were eliminated; and third, due to the sizing of the material, the tendency toward fixation of potash and phosphate was reduced.

The granulated or pelleted materials aren't a complete cure-all and are not advantageous in every case. Consumers, he believes, will increase their purchases of higher quality material. They have found that pelleted or granular materials are, in most instances, superior to the finely ground materials or small crystals, both from a result standpoint and from a physical handling and application consideration. From the production side, undoubtedly manufacturers will continue to improve uniformity of their sizing and will continue to include in their finished granules or pellets other elements required by the plants, and insecticides or fumigants for which the time of use is similar to that of the fertilizer.

It is possible to produce sulphate of ammonia as a crystal, a compacted granule, or as a pelleted granule. The performance as to shape and density of the product vs. the economics of producing each of these forms will be a subject for considerable investigation in the future, Mr. Dixon suggested.

SUMMARIZING his remarks on "Trends in Wholesale Distribution" Ralph S. Waltz, Vice President and Manager Agricultural Department, Wilson and Geo. Meyer & Co., San Francisco, said.

"It is apparent that the wholesale distributor has taken on a part of the distribution load previously carried by others. Some of the new wholesale distribution practices are good. The additional service, convenience and help in the use of products contribute to a greater fertilizer market. In a few cases, we find some stronger credit policies, such as cash discounts. These also tend to strengthen the financial position of our fertilizer business.

"Some of the practices we find, however, aren't good. Erratic terms of sale, too liberal credit, pricing practices that are not in keeping with the value of the product and the amount of service given—in other words, buying business without regard to profit.

"What can we expect in the future? What are the trends in wholesale distribution? It is becoming very evident that the supplier management is making more demands on its sales and distribution organizations. They want sound efficient sales policy. Suppliers all recognize that there is plenty of competition in the California market. Therefore, their sales policy must be realistic.

"The lengthy discussions about mixer-distributor-dealer will probably be eliminated and a new, more logical retail distribution link will be evolved. Performance and results will count most. Prices will gradually reflect the service given. Management will want volume, but will also demand profits.

"Terms of sale through trial and error will probably return gradually to certain trade standards. The good manager will have advantages for paying cash. The lending institutions will finance more fertilizers and the suppliers less. Sales departments will build their promotion around the good points of recent surveys which show that service and profitable results from using fertilizer will build bigger fertilizer sales.

"The methods of wholesale distribution will continue to be a mixture of—

1. Completely integrated movement of the product from the basic supplier and producer to the grower.
2. An efficient system using separate firms or companies in each of the following capacities:
   a. Producer
   b. Wholesale distributor
   c. Retail distributor

"Either method can be profitable and effective. All of the functions are real and must be compensated, whether they are integrated in one company or separated and given to individual companies to execute."

Considering his topic "Trends in Ammonia Marketing," D. W. Galbraith, President of Agriform of Northern California, outlined the following trends;

1. Ammonia for direct application will continue to supply nearly half of the ever-increasing California demand for plant food.

2. Retail prices will probably continue erratic until new production has found its place in the market. Wholesale prices are very apt to move downward.

10,000 hours . . . only $700 repair costs

Work record of first Michigan Tractor Shovel important since today's Michigans have same basic power train design

When the first Michigan Model 75A Tractor Shovel rolled out of Clark's Benton Harbor (Michigan) plant in 1954, company engineers *knew* it was good. But who could expect it to put in 10,000 working hours on a tough job . . . and still be "good enough to last many, many more years," (according to the satisfied owners, Indiana Farm Bureau's Indianapolis fertilizer plant). Five months a year, their "old" 1¼-yard Michigan Tractor Shovel operates on *a three-shift basis*—moving an average of 60,000 pounds of superphosphate and other materials *per hour* from storage piles to mixing units. It also handles mixed fertilizer, cleans spillage, and pushes freight cars.

Still has original tires, axles

In service equivalent to 5 years' normal 8-hour-a-day use, replacement parts have cost only $700, according to Lewis Risinger, Master Mechanic. "And," he says, "we've *never broken an axle, or replaced a tire,* which is unusual in our operation. I need only three socket wrenches to take the whole power-train apart—it's a fast, simple job that sure cuts downtime."

Operator praises power shift transmission

"I've noticed," says Plant Supt., Melvin Leach, "that whenever there's a choice, operators always pick the Michigan. Even a new man learns to operate it in a hurry." Operator Bob Jefferson especially likes the "power shift and steer, the bucket action, and the fact you don't have to 'grind' gears and wheels to keep close to the pile."

Liked the first—bought four more

Since he authorized purchase of this first Michigan Tractor Shovel, Ben Scharrer, head of the Bureau's Fertilizer Division, has bought four more Michigans for Bureau plants in Indianapolis and Jefferson, Indiana. "One of the things I've been pleased to see," says Mr. Scharrer, "is that there have been no changes in the basic Michigan design. Except for natural wear, the first Michigan is as up-to-date as machines coming off the line today!"

6000th MICHIGAN NOW ON THE JOB

Michigan Tractor Shovel No. 6,000 —produced a little over two years after the first one—is now at work for Ohio Gravel Co., Cincinnati. It has the same all-Clark "flywheel to drive-wheel" power train as do the first and all other Michigan Tractor Shovels.

Michigan is a registered trade-mark of

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3. Many marginal operators desperately fighting and meeting every competitive offer in the field will fold and drop out of the scene within the next two years.

4. Aqua converters (other than basic producers) reselling through dealers are through. They must either consolidate themselves and revert to dealer status, or be in a position to supply their dealers with products and services not currently available from basic suppliers and at the same time exercise some measure of financial control over those outlets. They obviously must be paid for the extra service rendered and therefore must charge their dealers higher prices for product than are currently quoted by basic suppliers.

5. Very large users fully equipped for storage and application are entitled to buy at a better price level than those requiring service. Whether or not they are ethically entitled to a manufacturer's price is debatable. Personally, I think not. They were contented at one time with a resonable price differential. However the break has been made and retraction is difficult. Perhaps the Co-ops will resolve this problem for industry.

6. I believe most basic producers are genuinely alarmed at the jeopardy with which their dealers and distributors are faced. They concede the importance of a healthy dealership organization to their marketing scene and will take steps to protect that vital link to the consumer.

Discussing what can be done to improve the situation Mr. Galbraith emphasized that dealers must be equipped to render full and complete service. They must apply realistic cost accounting principles to every phase of their operation and be willing to say "no" to unprofitable business. Salesmen must be taught to sell service, knowledge and reliability and that the word "price" is incidental, rather than the all-important topic.

Price-cutters, the speaker reminded, are as inevitable as death and taxes. Any industry operating under the free enterprise system and without government controls in a surplus production market will always be faced with this problem. But if as much selling time were devoted to educating present customers to use optimum amounts of fertilizer as is spent trying to noodle a competitor's customer away from him—the present agricultural ammonia surplus could well disappear.

Industry must support its distributor and dealer group, not deal around them, Mr. Galbraith concluded. A complete reappraisal of the terms "distributor" and "dealer" should be made. If a dealer or distributor is not equipped to perform his function, he should be replaced. But most certainly his margins should not be given to others. Brokerage operations should be discouraged at every turn.

TRENDS in Retailing was the subject of James F. Sloan, president of J. F. Sloan Company. Quoting Mr. Sloan;

"The tendency of basic products at the retail level is alarming to distributors all down the line, especially those with investments in plant equipment. It is obvious that these conditions have been brought about by the dislocations caused by the production of fertilizer tonnage that the farmer is not yet ready to use. Three factors may stop this trend.

"The first factor is *time*.

"When the farmer ultimately realizes that to take full advantage of his land potential he must in some cases double the amount of fertilizer he now uses, the excess tonnage will rapidly disappear, and the necessity and urgency which now plagues sales managers will give way to a more sane appraisal of the marketing problem and a more uniform approach to its solution.

"The second factor is *credit*:

1. If the present trend continues, slight though it is, then the credit problem must become more acute. Fertilizer producers are often far removed from the fields of their farmer customers, and it is almost impossible for credit managers to keep a competent hand on the economic pulse, especially when in most cases their advice and information comes from a salesman who is primarily interested in selling rather than credit. It is a primary assumption that it must be easier for a credit manager to administer his office with a hundred customers doing a hundred million dollars worth of business, than with a thousand customers doing the same dollar volume.
2. It would seem logical, that even before production and consumption are brought into balance that it would be expedient for basic producers, instead of continuing this trend, to select retailers in the various marketing areas of the State that have sound management, and make them their marketing agents and representatives, strengthening them economically through sound extension of credit, and other financial means at their disposal.

"The third factor is service:

It is a basic fundamental that a farmer is willing to let someone else do a job for him if he knows that this person can do the job as well or better than he can, and at less cost. That service to the farmer can become a potent weapon, whether it be in the form of application of the retailer's products or as an advisor on products to use in specific crops."

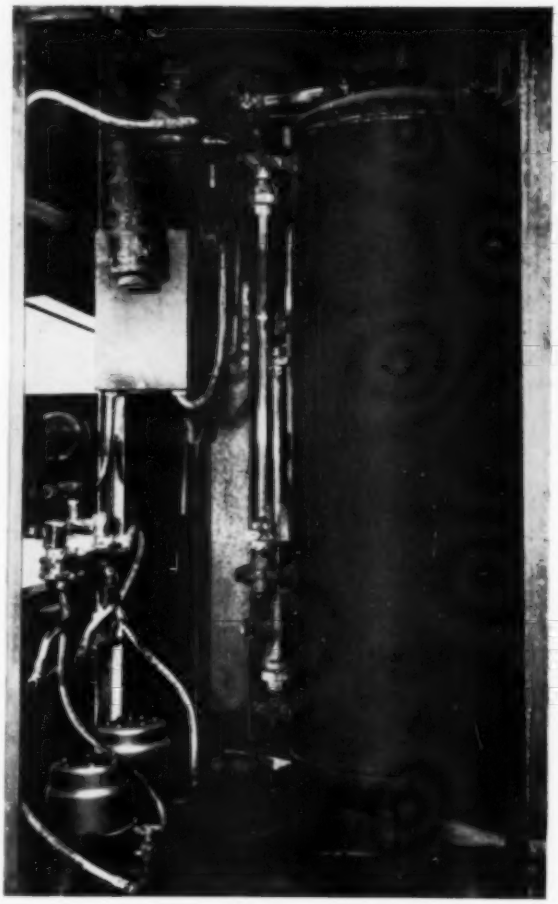
Handles fertilizer solutions with an

EXTRA MARGIN OF SAFETY

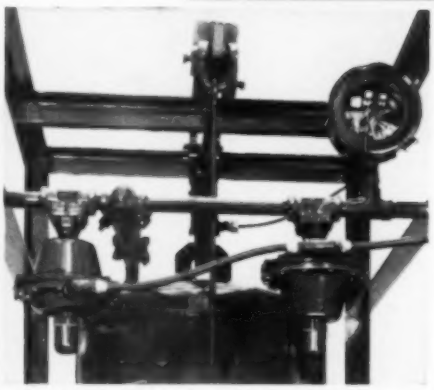
The fertilizer solutions industry is turning more and more to Grinnell-Saunders Diaphragm Valves for trouble-free performance and long life. The design of the valve provides smooth, streamline fluid flow and positive closure. Diaphragm completely isolates bonnet mechanism from corrosive fluids in the line and eliminates the possibility of troublesome stem leaks.

Maintenance is less a problem with Grinnell-Saunders Valves, too. The only part of the valve that ever needs maintenance is the diaphragm, which can be changed in minutes without removing the valve from the line. No refacing or reseating is required.

Grinnell-Saunders Diaphragm Valves are unsurpassed for handling fertilizer chemicals as diverse as nitric, sulphuric, phosphoric acids and their ammonium, sodium or potassium salts. Bodies available in cast iron (plain or of rubber lined), aluminum, stainless steel; diaphragms rubber, neoprene, teflon, or other synthetics. Handwheel, quick-acting lever, or power operated. Grinnell Company, Inc., Providence 1, Rhode Island.

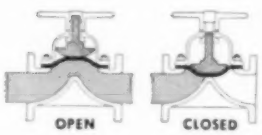


AT BASE . . . Two 2" Grinnell-Saunders Diaphragm Valves, with Bendix-Westinghouse topworks. Left hand valve opens at start of cycle. When predetermined weight is reached, this intake valve closes automatically — while the outlet valve at right opens, permitting emptying of tank.



AT TOP . . . Two ¾" Grinnell-Saunders Diaphragm Valves with Grinnell Air Motor topworks. Right hand valve acts to vent tank during filling. When maximum capacity is reached, right hand valve closes and one at left on compressed air line opens, to force out anhydrous ammonia.

▲ THIS WEIGHING TANK, manufactured by Fertilizer Equipment Sales Corporation, Atlanta, Ga., is used for weighing ammonium nitrate solutions, sulphuric acid and anhydrous ammonia. When preset weight is reached, scale balance trips microswitch, activating power-operated Grinnell-Saunders Diaphragm Valves which automatically perform the following: (1) shut off ammonia to tank; (2) close air vent from tank; (3) open compressed air into tank; (4) release ammonia into the fertilizer mixer located nearby.



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Washington Horticultural Association Reviews

Causes For "Complaints" of Insect "Resistance"

FAULTY application of pesticides, either through poor timing, too high speed in traveling through the orchard, trying to spray in wind, or other improper techniques, accounts for many of the complaints about "resistance" to insecticides.

This was indicated strongly by several speakers during the three-day, 54th annual convention of the Washington State Horticultural Association in Yakima, December 8 to 10. Chemical manufacturers are developing an arsenal of new materials for reserve ammunition against those pests which have actually become resistant.

Two entomologists, Fred Dean, USDA, stationed at Yakima, and Stanley Hoyt, whose headquarters are at the Tree Fruit Experiment Station, Wenatchee, agreed that a low level of resistance to DDT — similar to that of house flies — has been developing among codling moths. Hoyt declared that where sprays had been carefully timed and applied by hand, 6 per cent wormy fruit resulted when DDT was used alone, but the apples were worm-free when newer materials were used.

On the other hand, Ezra Crist, field man for the Ninth Street Skookum Growers (one of the largest cooperatives in the state), declared he could find no evidence of resistance. Appearing on a pest control panel composed of scientists and field men, Crist was one of several who indicated that in many cases growers could blame themselves for inability to check the moths and mites.

DDT and parathion make the most effective combination in Hoyt's opinion, but Sevin, Guthion, and Diazinon are also highly effective.

Pear psylla, which developed three complete and a partial fourth generation this past season in Washington, are more tolerant of some insecticides in the hard-shell stage than in earlier nymphal stages, according to Everett Burts. He is another entomologist from the Washington State College Tree Fruit Experiment Station in Wenatchee who appeared on the panel.

Burts found psylla resistant to Dieldrin, BHC, Lindane, Toxaphene and similar chemicals. In a "survival of the fittest" pattern, insects with ability to resist a pesticide gradually increase in an orchard until a resistant strain appears, he pointed out.

He added that exact measurements were not possible in his trial plots because psylla travel considerable distances and some undoubtedly moved in where his experiments were being conducted. Dean declared that he had obtained 100 per cent psylla control with Dieldrin, Diazinon and Ethion.

E. J. Newcomer, recently retired as the chief USDA entomologist in the Yakima laboratory, who presided on the panel, pointed out that in the majority of orchards pear psylla apparently were being controlled with Dieldrin.

Virgil Delegans, field man with the Blue Ribbon Growers, Yakima, added that lime-sulfur and oil in the pre-bloom stage dried up psylla eggs. Very few insects have shown resistance to lime-sulfur or the lime-sulfur-oil combination, he commented. Dormant and delayed dormant sprays, which went out of fashion shortly after DDT was introduced, are back on the program and are important in an orchardist's pest-control work, he declared.

Guthion has shown promise on Dieldrin-resistant psylla, and Sevin is good, but more applications are required, according to Delegans, who formerly was a county agent at Wenatchee.

Because of the unusually long, hot summer, mites developed earlier and faster than growers expected, causing much trouble, the panel agreed. Also, the spray materials broke down faster in the intense sunlight. Tedion has looked very good this year, Hoyt commented, with good knockdown and control. It should be used fairly early in the season, the second cover, or the third cover if the mite population is not high.

New methods of testing absorption of blossom-thinning materials were outlined by L. P. Batjer, USDA principal physiologist whose headquarters are in Wenatchee. These tests indicate that addition of a surfactant such as Tween 20, X-77 or Triton X-114 provided a "safener" in blossom-thinning sprays.

Slow drying conditions produce a significant hazard, particularly with Tween 20 increasing the rate of absorption of DNOC. However, the other two materials or Tween 20 proved safeners with the amide family of fruit thinners used two weeks to 18 days following full bloom. Batjer indicated that $\frac{2}{3}$ pint of Elgetol or $\frac{1}{3}$ pound of DNOC on Delicious at full bloom without a surfactant could be tried, with an additional spray of naphthaleneacetic acid plus a surfactant two weeks or 18 days later if additional thinning was deemed necessary.

Because the additives increase the effectiveness of the thinners, they should be used at lower concentrations.

Scale insects that at one time apparently were well under control have multiplied as a result of some new spray programs in many Washington orchards, Edward W. Anthon, Washington State College entomologist from the Tree Fruit Experiment Station, told the convention. San Jose scale has been particularly bad on cherries, with the previously effective parathion apparently not achieving results it once did.

Trials of parathion and oil were abandoned at one time because of their hazard. However, Volck Supreme oils alone or in combination with various materials have been under trial for the past

two years. Results indicate that parathion, Trithion and lime-sulfur, each combined with oil, gave excellent control in 1957 and good control in 1958 (except that parathion used without oil did not).

Pre-bloom sprays in late March were followed by a second spray of 1 pound of parathion alone after cherry harvest. Scale counts were made two months and eight months after the first spray.

European fruit lecanium can be controlled with a dormant application of oil or a pre-pink spray of 1 pound parathion or 1½ pints of malathion, according to Anthon. Severe infestations may require a pre-pink and a shuck spray. Even without the earlier sprays, parathion or malathion in mid-July will still give control, but damage to fruit from dew secretions of the scale will have occurred by this time, he added.

Peach twig borers are causing more trouble than formerly, Anthon declared. Experimental evidence indicating that they are becoming more difficult to control was cited. Preliminary results from tests indicate that Dieldrin, Endrin, Sevin, Diazinon, Guthion, Thiodan, DDT plus Toxaphene, and DDT plus Volck Supreme oil are promising. DDT plus parathion also continued to give good control of the twig borer as well as of catfacing insects.

Kelthane, Aramite, Sulphenone and wettable sulfur applied pre-bloom and in mid-July control peach silver mites. To avoid visible residues in controlling cherry rust mite, the sprays must be applied 35 or more days before harvest, and only Kelthane and wettable sulfur have been approved for use, although the other materials listed also are effective. A post-harvest spray is worth while if the summer spray has been missed, Anthon declared.

Development of a urine test for presence of toxic pesticides in the human system was outlined by W. F. Durham, U.S. Public Health Service toxicology laboratory, Wenatchee. The test is more sensitive than the blood cholinesterase level, but the sample must be obtained within 24 hours after the person has been exposed. If it is taken 48 hours later, it is of little value because the fraction of the poison which is eliminated in this manner is excreted fairly soon. On the other hand, the cholinesterase level may be affected for a month or more, the speaker commented.

Wooly and green aphids on Golden Delicious are best controlled with Sevin, or with Malathion and DDT in the second cover, but slow-drying materials may damage the small fruits, it was brought out in a question and answer period when this subject was discussed. Growers were advised to avoid using Parathion or even Malathion. Sprays should be applied in the heat of the day for quick drying, and not late in the afternoon.

Cyprex applied in the dormant and petal fall stages and again during the first week of September held bull's-eye rot to almost zero, according to Roderick Sprague, Tree Fruit Experiment Station plant pathologist. Captan, Ziram and Maneb in spring and fall applications also gave control.

Development of many of the molds in cold storage can be forecast by holding some of the fruit at room temperature, it was brought out by the same panel on which Sprague appeared. Several organisms can cause bull's-eye rot, C. F. Pierson, Wenatchee, U.S. Agricultural Marketing Service, pointed out.

Careful control of the amount of nitrogen supplied each tree will help extend the apple harvest period, according to John O. Johnson of the Crane & Crane orchards, Brewster, Wash. Various plots in the 100-acre tract are "rotated" on the "low" (2.2 lbs. actual nitrogen per tree) application rate. The rest of the orchard receives 3.1 pounds actual N per tree.

Peaches grown under low nitrogen conditions are stringy and astringent, E. L. Proebsting, Jr., pomologist at the Washington State College Irrigation Experiment Station, Prosser, another speaker on the panel with Johnson, brought out.

Iron deficiency symptoms show up in grape vineyards when they are improperly irrigated, W. J. Clore, also at the irrigation experiment station, told the convention. He added that too much nitrogen actually reduces grape yield.

Moisture is the key to success with weed control chemicals applied to the soil, R. M. Bullock, superintendent of the recently-developed North Willamette Experiment Station, Aurora, Oregon, reported. The ideal condition is to have the surface moist as long as possible, without too heavy wetting of the lower portions of the root zone. Organic matter tends to reduce the efficiency of these chemicals. Conversely, on light, sandy soil, the orchardist may experience injury to young trees when he endeavors to control weeds with chemicals.

Bullock suggested that quack grass in the young orchard should be removed by tillage first, then after the soil has been smoothed or irrigated, the weed-killing material can be applied. Foliar applications can be used on grass shoots or other weeds that appear later.

In commercial orchards, costs were estimated at 9 cents a tree, including the cost of pulling dead weeds from around them when 8 pounds of amino trizole with a wetting agent was used in 100 gallons of water. This was the report of John Bloxom, Jr., who operates one of the largest fruit-growing projects in the Yakima Valley.

Because organic matter reduces effectiveness of the chemicals, Bullock suggested that no mulches be used around the trees until dry weather arrives. Pears are one of the most tolerant of fruit trees to the weed killing materials, but the only chemicals that check wild morning glory also "control" pear trees, he added.

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WESTERN STATES
INSECTS: wireworms, root maggots, strawberry root weevils, flea beetles, clover root weevils
CROPS: vegetables, corn, potatoes, berries, other crops
TIMING: March & April

CORN BELT STATES
INSECTS: corn rootworms, wireworms, cutworms, white grubs, seed corn maggots, Japanese beetle larvae, root weevils
CROPS: corn, potatoes, vegetables, other crops
TIMING: March, April, May

KENTUCKY
INSECTS: wireworms, mole crickets, seed corn maggots, tobacco webworms, green June beetles, cutworms
CROP: tobacco
TIMING: April & May

EASTERN STATES
INSECTS: wireworms, white grubs, European Chafers, rootworms, Colorado potato beetles, flea beetles
CROP: potatoes
TIMING: January through April

SOUTH CENTRAL STATES
INSECTS: Rough headed corn stalk beetle
CROP: corn
TIMING: March & April

GEORGIA-ALABAMA
INSECTS: wireworms, southern corn rootworms, white fringed beetle larvae, Colorado potato beetles
CROP: potatoes
TIMING: January and February

INSECTS: white grubs
CROP: peanuts
TIMING: March and April

THE CAROLINAS
INSECTS: thrips, southern corn rootworms
CROP: peanuts
TIMING: April, May

INSECTS: wireworms, cutworms, flea beetle larvae
CROP: tobacco
TIMING: March

INSECTS: wireworms, southern corn rootworms, white grubs
CROP: corn
TIMING: February

FLORIDA
INSECTS: wireworms, cutworms, white grubs, white fringed beetles, mole crickets, rootworms, flea beetles, ants
CROPS: sweet corn, tomatoes, potatoes, melons, vegetables, other crops
TIMING: September through December

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New Sparger Design Aids Fertilizer Mixing

DEVELOPMENT of an improved sparger for fertilizer mixing has been announced by Spencer Chemical Company. Designed to cut costs by reducing "down time" and to improve product quality through better solution-acid distribution in the mixing process, the new sparger was perfected in the mixed fertilizer demonstration unit at Spencer's Jayhawk Works. It is now in operation at several commercial plants.

The new design incorporates the principle of a continuous slit for distributing liquids evenly throughout the length of the sparger during the mixing process. In the past, pipes with holes drilled intermittently have been used for liquid distribution. To protect the holes from clogging and to attempt to even out the flow of liquids, the pipes were fitted with V-shaped lips. However, due to the thin metal that must be used to fabricate them, the lips corrode quickly and give only brief service.

According to Joe Sharp, manager of Spencer's Agricultural Technical Service Section, fertilizer mixers producing poorly granulated material can often trace this problem to improper liquid distribution in the mixer. "The sparger is literally the heart of the mixing process," Sharp said. "If the acid or nitrogen solutions are improperly distributed, whether through clogging of the sparger or excessive corrosion, poor granulation will result."

He said that an accumulation of these granulation problems in the industry led Spencer to begin its experimentation with the new design. "We now have a ruggedly built sparger which, because of its continuous slit design, gives uniform distribution and resists clogging. Because of the wide area from which liquids are dispensed, corrosion occurs almost uniformly along the edges of the slit, instead of in isolated areas. This helps to maintain even distribution and cuts down on 'hot spots' in the mixer which, in addition to poor granulation, can mean plant food loss, off-grade material, and air pollution."

In construction, the new sparger differs from pipe-type spargers in that a single block of metal replaces the separate acid and solution pipes. This block is fabricated from two pieces of bar metal held apart by a gasket inserted between the bars down the center and at the ends. The space formed between the bars by the gasket provides the continuous slit through which acid can flow from one side of the sparger and solution from the other. To facilitate even flow, grooves are machined into the interface of each bar. Pipes attached to the top convey acid and solution into the sparger.

Technicians say that in the pipe sparger, efficiency is completely lost when only ¼" of the metal is eroded or corroded away. More than 2" inches of metal protects the sparger from complete failure. Test models of the sparger had been fabricated from several different materials, ranging from carbon steel to corrosion-resistant alloys. Current indications are that a carbon steel model with alloy "lips" at the edges of the slits will prove the most practical.

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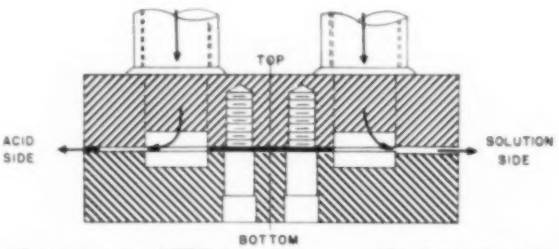
11th N. C. Pesticide School

The 1959 Pesticide School conducted by the School of Agriculture and the Division of College Extension of North Carolina State College, Raleigh, will be held Jan. 14 and 15 at the College Union Building on the campus.

The school will cover herbicides, fungicides, insecticides, and rodenticides and their application on such crops as tobacco, peanuts, cotton, corn, apples and grains. Besides instructors from the college, two visiting speakers will be on the program. They are D. E. Wolf, assistant district sales manager for E. I. du Pont de Nemours & Co., and T. B. Upchurch Jr., president of T. B. Upchurch, Inc.



The cutaway drawing shows the new continuous slit sparger designed by Spencer Chemical Co. Two pieces of bar metal are joined by bolts. The slits in the middle of each side are formed by gaskets placed down the middle of the bars and at the ends. Interfaces of the bars are machined to give a smooth, true surface.

The new sparger is shown (below) being examined by "Cotton" Graham (left) of the Fort Smith Cotton Oil Company. Slits running the length of each edge make possible even dispersion of the liquids used in the mixing process. From the pipes in the top, acid is distributed through one side of the sparger and solution from the other.

How To Sell More Anhydrous Ammonia Theme of Chicago Meeting of A. A. I.

By H. H. Slawson

THE eighth annual convention of the Agricultural Ammonia Institute, held in Chicago, Dec. 3 to 5, devoted primary attention to the problem of how to sell more anhydrous ammonia. Registration at the Morrison Hotel, totaled 590 persons from 31 states and Canada.

In the election of officers at the first session, S. C. Smith of the Smith Co., Uvalde, Texas, was chosen president. He succeeds Paul J. Duesterhaus, Quincy, Ill. Others elected were: First vice president—Carl Bauserman, So. Michigan Agricultural Nitrogen Co., Richmond, Mich.; second vice president—J. C. Struble, Standard Oil Co., Chicago; secretary — Hampton Pugh, Pugh Gin & Fertilizer Co., Tiller, Ark.; treasurer—David H. Bradford, Jr., Mid-South Chemical Corp., Memphis, Tenn. Retiring president P. Deusterhaus and Leland Hopkins, Jackson Tank Co., Jackson, Miss., were added to the executive committee.

A new safety manual is now ready for the printer, reported president Paul Duesterhaus in the opening address. If its common sense instructions are followed, it ought to save lives and reduce unfavorable publicity, he declared, but most of all it should help make the entire industry conscious of the necessity for safe operations. He told also of a large instructional decal, for attachment to nurse tanks for guidance of operators, which is expected to eliminate problems of the man who knows nothing about NH_3.

In both college and commercial laboratories a lot of research has been under way, he noted, and during the coming year the Institute will start assembling all known reports in the Memphis headquarters library, where they will be available to members. This, he thought, should be of immense help in further expansion of members' products.

Considerable effort has been expended, he went on, to get insurance companies to adopt "more realistic" rates on ammonia installations. "As the insurance people see that we know our business," he said, "I am confident that this phase of our operations will become increasingly brighter."

Jack Criswell, executive secretary of the AAI, revealed in his report that Institute publications are being sent to 9 foreign countries, including Russia. Membership now numbers 627 firms in 39 states, he said, directors come from 19 states. He paid tribute to the more than 100 committee men who, during the year, traveled extensively at their own expense, to further the Institute's interests.

Members will "have to get their selling clothes on all the time" if they hope to see the industry expand, declared Joseph E. Burger, H. V. Nootbaar Co., Pasadena, Calif., in the first of the series of talks on how to sell more anhydrous ammonia. He listed characteristics of the ideal salesman, and discussed at length their application to the business represented by the Institute. Summing up, he concluded with the advice "Get yourselves on fire with enthusiasm."

How the Illinois Anhydrous Ammonia Association has tackled the selling problem was outlined by its president, Kenneth W. Cross, Congerville, Ill. It was done, he explained, by developing a program aimed to get individual farmers to see the effectiveness of NH_3 in use on their own corn fields. They and their neighbors were encouraged to watch results where the fertilizer was applied. Dealer members of the Illinois association cooperated intensely, as did agronomists with commercial companies, he said, in such matters as layout of fields, different rates and depths of application and different planting rates.

An analysis of reports from 696 corn fields, Mr. Cross said, has demonstrated that nitrogen is an effective tool for raising his state's leading farm product, corn. These 696 fields, he stated, showed an average increase of 25 bushels per acre, where the average rate of application was 100 lbs. per acre. Net returns were also greater per acre when the rate was over 100 lbs. But the most significant finding, he said, was that on many farms use of anhydrous ammonia made the difference between growing corn at a profit or growing it at a loss.

Third in the series on selling came at the final session, when Dr. M. S. Williams, chief agricultural economist for the National Plant Food Institute, Washington, D. C., and Zenas H. Beers, director of NPFI's midwest office in Chicago, Ill., presented an outline of their organization's findings from a survey of farmers' attitudes toward use of fertilizer. A lengthy report on this survey, received wide attention when it was first released almost a year ago.

"Examine your customer for what he is, not for what you imagine him to be, or would like him to be," Prof. Hartzler of Kansas State College advised. "It takes chemistry, physics, biology to comprehend fertilizer. The farmer knows nothing about all that. Why not skip the 3-syllable words, talk to him in terms of food, — plant food, — not nutrients.

"At any rate, stop trying to 'educate' the farmer. There are too many of them. The man without an education resents the one who has it and shows it off. He feels at a disadvantage. He won't buy on the basis of education. He'll buy because some salesman has raised his hopes. What he's after is increased yield, income, but through

the 'educational' approach you can destroy a lot of customers. Keep away from technical talk."

Many dealers, Prof. Hartzler went on, are not competent to make recommendations on fertilizer use. "Don't try to play God," he advised. "Your prospect is a human being; he's an individual, different from all others. Show him how to use your product so it will give him what he wants."

The problems facing the midwest corn belt are many and serious, Dr. T. S. Hamilton, associate director of the Illinois Experiment Station, Urbana, Ill. declared in his discussion of this matter. The widespread clamor for halting agricultural research, he asserted, is erroneous and would lead to calamity. He pointed out that population is increasing and must be fed, but farmers, because of the price-cost squeeze, are leaving the farms. They will never be able to return, because tillable land is being converted to airports, big city suburbs, highways. And there is little new land available for replacing this loss of acreage.

If new disease-resistant crops are not developed, Dr. Hamilton, declared, crop yields could well be reduced by 50 per cent within 10 or 15 years. Like crops, meat animals are man-made today and constant study must be done to see that they do not revert to old conditions. Any farm program without research, would thus lead to regression.

He examined, too, mechanization and its resulting surplus burden on the nation, the decreasing water supply, corporation farming and vertical integration, now being widely discussed as one way to accomplish adjustments in agriculture under prevailing conditions.

It is only through research and its application that progress can be made, Dr. Hamilton concluded. Without research our vast agricultural industry would soon come to a standstill, he observed.

Still another outstanding program feature was the talk by Dr. Wm. A. Albrecht, University of Missouri, Columbia, Mo., whose topic was "Nitrogen, Proteins and People." Emphasis on energy-producing and fattening foods, Dr. Albrecht said, has gotten our cardiovascular systems into trouble, and protein is looked to as the means to save us from these physical difficulties. In a lengthy, scientific examination of nitrogen and its effective use, as a producer of proteins, he suggested how the dietary shift from starches and fats can be best accomplished.

Some 22 manufacturers and suppliers of NH_3 and application equipment presented their products and services in the trade exposition set up in the main meeting room and adjacent areas.

The Agricultural Ammonia Institute, it was announced, will hold its 9th annual convention, Jan. 13-15, 1960 at the Statler-Hilton, Dallas, Texas. For the tenth anniversary convention, Memphis, Tenn., was decided on at a date sometime in January, 1961.★★

Annual ESA Meeting in Salt Lake City New Experimental Pesticides Highlight

SOME new pesticide materials, reports on control measures for specific pest problems, and discussions on the role of attractants in pest control, were among the features of some 300 technical papers presented at the annual meeting of the Entomological Society of America, held December 1-4 at the Hotel Utah, Salt Lake City. Presiding at the opening session were R. L. Metcalf, retiring president; and president-elect, P. W. Oman. As in previous years, sessions were held concurrently during the five-day meeting for the following sections: general entomology; physiology and toxicity; biology; medical and veterinary entomology; control, extension and regulatory entomology; and chemical control investigations.

Entomologists A. R. Roth and James W. Eddy, of USDA's Agri-

ESA BOARD OF GOVERNORS

First Row (L. to R.): R. H. Nelson, Executive Secretary, ESA, Washington, D. C.; H. M. Armitage, Sacramento, Calif.; M. P. Jones, USDA, Washington, D. C.; R. L. Metcalf, President, ESA, Riverside, Calif.; P. W. Oman, President-elect USDA, Beltsville, Md.; C. P. Clausen, Citrus Experiment Station, Riverside, Calif.; E. H. Littooy, Colloidal Products, Sausalito, Calif.

Second Row (L. to R.): Roy Hansberry, Shell Development Co., Modesto, Calif.; B. B. Pepper, Agricultural Experiment Station, New Brunswick, N. J.; F. W. Fletcher, Dow Chemical Co., Midland, Michigan; E. Gorton Linsley, University of Calif., Berkeley; Morris Rockstein, New York, N. Y.; J. E. Bussart, Velsicol Chemical Corp., Chicago, Illinois; Neely Turner, Agricultural Experiment Station, New Haven, Conn.; C. M. Meadows, Southwest Sprayer & Chemical Co., Waco, Texas; Edward A. Steinhaus, University of California, Berkeley, California.

cultural Research Service, reported on tests they conducted using a new systematic insecticide for cattle grubs at Corvallis, Ore., during the 1957-58 grub season.2 The new organophosphorus compound is Dow Chemical's Dowco 109 (0-4-tert - butyl - 2 - chlorophenyl) - 0 - methylphoramidothioate). It can be administered either orally or as a spray, giving excellent results in either manner. Used orally, the chemical at the highest test dosages employed gave control amounting to 94 to 100 per cent. Used as a spray, it provided 99 to 100 per cent control. It is not yet available commercially.

Mr. Roth indicated that the experimental treatments were most effective when the dosage, administered in bolus or capsule form, amounted to 20 or 25 milligrams of the new chemical to each kilogram (about 2.2 pounds) of body weight of the test animals. Results were fair, however, when oral dosages of only 4 to 15 milligrams per kilogram of body weight were given. Researchers obtained nearly perfect control results when four quarts of spray were used per animal, while a 2-quart application gave about 70 to 80 per cent control. The spray formulation included a wettable powder containing .75 per cent active material. Sprays were applied under an operating pressure of 250 to 300 pounds.

R. O. Drummond and O. H. Graham, USDA, ERD, Kerrville, Tex., reported on tests with Dowco 109 as an animal systemic insecticide. Partial control of grubs was obtained with sprays of .25 and .5%; and intramuscular treatments of 10 and 5 mg/k. Early oral or intramuscular treatments of 15 and 25 mg/ and a 1 per cent spray were highly effective in preventing encystment of grubs.

Laboratory studies of SD 4402, a chlorinated adduct of hexachlorocyclo-pentadiene and 2,5-dihydrofuran, as an insecticide, were reported by entomologists from Shell Development Co., Modesto, California. The material was reported

Left to right: president-elect P. W. Oman, Ent. Res. Div., USDA, Beltsville, Md.; member of governing board, E. H. Littooy, Colloidal Products, Sausalito, Calif.; and ESA president, R. L. Metcalf, Citrus Experiment Station, Univ. California, Riverside, Calif.

to be an outstanding new pesticide, being toxic to a wide range of insects, and particularly effective against lepidopterous larvae.

Experiments with Co-Ral, Dimethoate and Trolene for control of cattle grubs were reviewed by J. G. Matthysse, E. Homan and E. Bay, Cornell University; and L. D. Haws, University of Kentucky; Good to excellent control of *Hypoderma lineatum, bovis* was obtained with all three materials in the following respective applications: 5% spray; 15 mg kg bolus; 100 mg kg bolus. Dimethoate as a 10 mg-kg bolus and Coral as a 25% spray were less effective.

Microbial Pesticide

A field test of commercially produced *Bacillus thuringiensis* for control of lepidopterous larvae on crucifers was reported by Irvin M. Hall and Lloyd A. Andres, University of California. All bacillus treatments used gave as good or better control than the equivalent dosages (on a pound-for-pound basis) of a standard chemical insecticide. Using .5 to 1.5 pounds of the bacillus at an arbitrary standard of 100 billion spores to each gram of dry material in 30 pounds of insect dust per acre, they achieved 80 to 100 per cent kill of the cabbage looper and imported cabbageworm. (A discussion of microbial pest control appears on page 45 of this issue of *Agricultural Chemicals*).

Several reports dealt with the protection of forest products from insects and the programs underway for control. L. W. Orr, USDA, advised that present forecasts indicate a growing need for increased production of forest products. Development of more effective controls for termites, powder-post beetles, ambrosia beetles, and other wood destroying insects will help to prevent future shortage of timber. Forest insect surveys and aerial survey research were reviewed by A. E. Landgraf, Colorado State University; B. H. Wilford, U.S. Forest Service; and D. C. Schmiege, and J. L. Bean, both of the University of Minnesota.

Miscellaneous Pest Control

Experiments conducted in 1956-68 to determine the effect of varying rates of granular toxaphene, heptachlor, and endrin on first and second brood European corn borer were reviewed by M. L. Fairchild, ARS, USDA, and T. A. Brindley, Iowa State College. They stated that at the rates tested there was very little difference in the effectiveness of the three insecticides.

Norris E. Daniels, Texas Agricultural Experiment Station, reported that greenbug control with the systemic phosphorus compounds, demeton and di-syston, was little or no better when the pesticides were used in combination with different rates of nitrogen and phosphorus fertilizers than when applied alone.

Experiments dealing with the effectiveness of different types of

spray nozzles for controlling cotton insects were reported by J. C. Gaines and P. L. Adkisson, Texas A. & M. They reported that effective control was obtained only with a single number 6 nozzle or two number 3 nozzles per row. Control of the bollworm was obtained with all the nozzle types tested.

Although the imported fire ant is a considerable nuisance, Louisiana State University scientists hope to find some useful purpose for this pest. Dr. Phillip S. Callahan and Dr. M. S. Blum reported to the group that the fire ant's venom exhibits strong antibiotic activity against several medically important bacteria. The venom also kills molds. In addition to its antibiotic activity, the venom kills insects and mites by contact.

Safe Use of Pesticides

Joseph H. Holmes, University of Colorado Medical Center, urged cooperation among physicians, pesticide manufacturers and applicators to cope with the problem of accidental poisoning. He suggested the restriction of recently sprayed areas for at least the first 24-hour period (particularly where spraying is adjacent to suburban areas); and asked for cooperation between the medical profession and persons using insecticides so that both will understand the problem and be able to work effectively together.

More than 650 entomologists, researchers, and industry representatives attended the five-day meeting.

Chairman of the program committee was L. D. Anderson. Other committee chairmen were: local arrangements, George F. Knowlton; exhibits, A. D. Hess; resolutions, Herbert Knutson; ladies entertainment, Mrs. G. F. Knowlton and Mrs. D. M. Rees.

NAC at Health Protection Conf.

A conference scheduled by Arthur S. Flemming, Secretary of Health, Education and Welfare, was held December 11th in Washington, D. C., for discussion of health protection of the American people with particular concern for the manufacture, storage and distribution of food.

Comments at this meeting by J. V. Vernon, president of NAC, emphasized NAC's past record and continued efforts to work toward the type of legislation that will adequately protect the public,—yet at the same time not be harmful to the agricultural chemicals industry. He observed that "NAC and members of our industry feel that the Miller Amendment is a good sound Law and we are all learning to operate satisfactorily under it."

Mr. Vernon also suggested that some simplified procedures might be developed for determining toxicity of and for registration of products for use in agriculture. "To this end," he said, "A committee of our Association has been working the past year with both the Food and Drug Administration and the USDA. Though we don't always agree, I feel that a continuing effort along these lines will be beneficial to everyone concerned in the pesticide business."

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N.C. Soil Science Meeting

The second annual meeting of the Soil Science Society of North Carolina has been set for January 27 and 28, 1958. This Society, organized in Raleigh October, 1957, has as its principal objective to increase and disseminate knowledge of North Carolina soils and their use. The January meetings will be held in Williams Hall, N.C. State College, Raleigh.

College personnel, agricultural workers throughout the state, representatives of fertilizer and lime industries, and others interested in soils are eligible for membership in the Society. The 1959 meetings will include special reports on new developments in fertilizers, tobacco and forest fertilization, soil extension programs, and chemical and physical problems with North Carolina soils.

Arsenic Noted In Tobacco

A research group of the Southwestern Medical School of the University of Texas in Dallas, headed by Dr. Robert H. Holland, reported last month that cigarettes contain at least fourteen times as much arsenic as is permitted in food.

They said that arsenic was "the only component in cigarette smoke that was known to be carcinogenic (cancer causing) to man. The scientists reported that the increased use of arsenic compounds as insecticides since the late nineteenth century had paralleled the rise of lung cancer deaths in the U. S. The report is contained in a recent issue of *Cancer*, a journal of the American Cancer Society.

The chairman of the Tobacco Industry Research Committee, Timothy V. Hartnett, said that the implications in the article seem to go far beyond anything warranted by known facts.

L. B. Reed of the Plant Industry Station, Beltsville, Md., and chairman of the National Agricultural Chemicals Assn's. Arsenic Committee, Washington, D. C. said that arsenics have not been recommended as insecticides by the U. S. Department of Agriculture or any state departments of agriculture in the flue cured tobacco areas since 1952. The NAC said that arsenics were dropped when Great Britain refused to buy U. S. tobacco that had been sprayed with arsenics. In 1953, U.S.D.A. leaflet No. 336 recommended that no arsenics be used on tobacco.

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SW Fertilizer Work School

Supervisory personnel from fertilizer plants in the Southwest met during Fertilizer Safety Work Course at the Sheraton-Terrace Motor Hotel in Austin, Texas, on November 13 and 14, 1958. This was the fourth in a series of regional safety schools sponsored jointly by the Fertilizer Section of the National Safety Council and the National Plant Food Institute. Registrants for the Austin school included safety directors, personnel managers, and production supervisors

Equipment, Supplies, Bulletins

New Horizontal Mixers

A new complete line of horizontal mixers is announced by The Young Machinery Co., Inc., Muncy, Pa.

A 12 page bulletin gives complete dimensions for mixers up to 500 cubic feet working capacity and illustrates various arrangements of ends, supports, agitators, shafts, glands, covers, inlets and discharges, gates and drives.

A complete mixer to your specifications can be assembled on your drawing board. A check-list is included to insure proper selection of the desired mixer components.

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Antara Chemicals Catalog

Antara Chemicals, a sales division of General Aniline & Film Corp., New York, is offering an expanded and revised chemicals catalog. The catalog is divided into separate sections devoted to surfactants, organic intermediates, acetylene derivatives, carbonyl iron powder, ethylene oxide and glycols and numerous specialty chemicals.

The free catalog is available from the company at 435 Hudson St., New York 14.

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Thayer High Speed Scale

A new high speed packing (or bagging) scale is being offered by the Thayer Scale Corp., Pembroke, Massachusetts. This Thayer Model 2N18CC is an automatic duplex filling unit consisting of two net weigher scales discharging into a common hopper.

Extremely high speeds with pin-point accuracy; double feeder permitting either single or dual operation; and a control panel giving the operator continual view of the scale's operational cycle are advantages claimed for the machine.

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Frazier Elevating Conveyor

The model CA Whiz-Lifter, an elevating conveyor manufactured by Frazier & Son, Clifton, N. J., is designed to handle almost all types of products from solids to powders. It has interlocking buckets that travel on a horizontal plane at point of fill and can feed more than one machine as well as discharge from either side or from alternate sides.

The lifters are constructed from a standard design, but each machine is custom built to meet specific plant and production requirements. Additional information can be obtained from the company at 20 Industrial West., Allwood, Clifton.

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Munson Mixers Folder

Rotary Batch Mixers are described in a folder issued by the Munson Mill Machinery Co., Utica, N.Y. The four-page, two-color folder gives pictures and specifications of two types of mixers, Type 4 and Type 7.

The mixers are of heavy duty, welded steel construction with accurately machined parts. Rotary action tumbles, turns, cuts and folds, and is said to give fast accurate blending without stratification or reducing particle size.

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New Geigy Sequestrene

Geigy Agricultural Chemicals, division of Geigy Chemical Corporation, New York, announces the availability of Sequestrene NaFe Iron Chelate on Vermiculite.

This new formulation provides Sequestrene Iron Chelates in conveniently applied form for correction of iron deficiency (chlorosis) in citrus, ornamentals, turf and agricultural crops growing in acid soils. It contains 5% iron as metallic.

Sequestrene Iron Chelate on Vermiculite is granular, free-flowing, dustless. It does not adhere to foliage and there is no danger of burn. It may be used alone, or is easily mixed with fertilizer.

Rotary Paddle Feeder

Formulation inaccuracies resulting from pulsating material delivery are said to be eliminated by a newly-designed rotary paddle feeder developed by the Richardson Scale Co., Clifton, N. J.

The new feeder is based on a series of paddles which revolve around a stable drum within a housing. Uninterrupted material flow is further assured by a regulating baffle at the discharge point. Complete information and specifications are available from the company at Van Houten Ave., Clifton.

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Clarklift Scale Attachment

A 5,000 pound capacity weighing attachment for fork-lift trucks now is available on the 3,000, 4,000, and 5,000 pound Clarklift model trucks manufactured by the Industrial Truck Division of the Clark Equipment Co., Battle Creek, Mich. The scale is said to be accurate to two-tenths of one per cent of its capacity.

Developed jointly by Clark and the Baldwin-Lima-Hamilton Corp., the unit utilizes a steel column rather than a spring to support load being weighed. The attachment's use reduces travel and eliminates frequent pick-ups and set-downs required when floor scales are used, the company said. Company information on the Baldwin-Clark weighing attachment may be obtained from the Industrial Truck Division of the Clark Equipment Co.

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High Speed Machine For Bags

The Union Special Machine Co., Chicago, is offering a high-speed sewing head for closing medium and heavyweight bags made from burlap and single ply or multiwall paper.

FERTILIZER VIEWS

(*From Page 73*)

Emil Truog (Wisconsin Agricultural Experiment Station): "Addition of phosphate and potash fertilizers to Wisconsin soils has in many cases improved the quality or nutritive value of the crops produced. About 20 years ago dairy cattle in several areas of northeastern Wisconsin were suffering from a so-called Pica disease caused by an inadequate content of phosphorus in the feed. This condition has now been corrected through the addition of superphosphate to the soils which greatly increased the phosphorus content of the forage. In some cases the phosphorus content was nearly doubled . . . . Numerous examples could be given from Wisconsin in which the application of one chemical fertilizer or a combination of several has corrected soil deficiencies so that normal vegetables of high-food value could be produced."

Dr. K. C. Beeson (U.S. Nutrition Laboratory, Cornell): "Insofar as it is possible to measure nutritive value by laboratory techniques it can be stated that the soil exerts a major influence on the mineral nutrient content of the crop. Fertilizers make possible a wider choice of those crops of high nutritive value that can be grown on any soil or in any climatic region.

Dr. Firman E. Bear: "Fertilizers represent one of the most remarkable contributions to the needs of man that industry has ever made. They stand between us and any possible shortage of food for centuries to come. Rightly used they produce the best of food."

The fertilizer industry serves a basal need in our economy in the production of food and feed of high nutritive value. In this sense it can be said that this industry contributes to the maintenance and improvement of the general well-being of the Nation.★★

AGRICULTURAL CHEMICALS MARKET REPORT

THE reductions in West Coast anhydrous ammonia prices, announced in mid-October, are expected to be the start of a period of two or three years of lean times for producers and distributors of nitrogen fertilizers.

The effective price of NH_3 dropped abruptly from about $88 to $66 per ton. One of the first companies to adopt the lower prices was the Shell Chemical Co. which supplies about 20 per cent of the anhydrous ammonia sold west of the Rocky Mountains. The company said that it was making the price decreases because of the volume losses and other adverse effects felt by Shell distributors and dealers as a result of others offering to supply fertilizer at prices below those generally prevailing.

Other major producers indicated that they would lower prices, also. The combined capacity of plants on the West Coast is estimated at 1,560 tons per day, compared to actual output of only 800 tons per day. Industry officials say that the spread between production and capacity is the fundamental cause of the price weakness.

Whether or not present price levels will be maintained is problematical, but it would seem that some increases will have to be made. The production cost of NH_3 now is about $50 per ton, and sales and distribution costs are at least $15 per ton. This abviously leaves only a meager margin.

The Aikman Report, released last month in London, estimates that world production of nitrogen (excluding Russia) for the 12 months ending June 30, 1959, will be 10,452,000 metric tons. Consumption is estimated at 9,857,000 metric tons, indicating an excess of production over consumption at 595,000 tons.

This compares with excess production in the preceding 12 months of 225,000 metric tons and with 179,000 tons two years ago.

The British firm notes, however, that the general outlook is not as pessimistic as the figures indicate and, if the necessary co-operation among producers takes place, the temporary estimated surplus should not unduly disturb the market.

Stocks in Europe on June 30, 1958, were estimated at under 300,000 tons and were represented largely by ammonium nitrate and urea. In the U. S. and Canada, the next largest producing markets, stocks are more or less normal, the report said. The largest producers in the U. S. and Europe have tended to reduce production because of low prices and this trend may continue next year. It is possible, therefore, that the estimated surplus may be considerably less than the present figures indicate.

DDT prices have been advanced a full cent a pound by a major producer, Montrose Chemical Co., of California. The new price for flake or chipped material is 23 cents per pound for carlots to spot customers. Montrose's price for powdered material has been increased by the same amount to 24 cents per pound.

The DDT market has become stronger, reflecting heavy purchases by the government.

F-P CONSUMPTION

(*From Page 42*)

pesticide were consumed principally in Iowa, Tennessee, Florida, and Illinois.

The use of IPC and inorganic pesticides was an additive to materials only. IPC added to gypsum and sulfur was consumed only in the western states, particularly Washington. Lead arsenate added together with chlordane to ferrous ammonium sulfate was used exclusively in Utah and Nevada, while arsenical compounds were added to low nitrogen organic materials in California.

Other products totaling 5,005 tons were compounded with BHC, 2,4-D, DDT, dieldrin, or toxaphene in varying concentrations.★★

COTTON CONFRENCE

(*From Page* 44)

sequently, the formation of the reproducing adult stages, appears to offer a new approach to insect control. A chemically defined diet will be necessary before research on antimetabolites can make progress.

10. Native Habitat Study – A study of the boll weevil in its native habitat may result in finding effective parasites, predators, or diseases not present in the United States.

Fertilizing Cotton

THE importance of nitrogen and calcium in improving cotton quality were noted by George J. Harrison, Calcot, Ltd., Bakersfield, Calif., and A. B. Wiles, plant pathologist at Mississippi State University, State College.

Mr. Harrison in describing the effect of high nitrogen use said that up to a point, nitrogen can profitably be added without adversely affecting fiber quality. However, excess rates may lead to conditions that produce fiber which is large in diameter, irregular in circumference, and poor in structural alignment. "A wise use of nitrogen, combined with timely insect control, often results in maximum yield in a minimum length of time."

Dr. A. B. Wiles said calcium appears to benefit cotton seedlings by developing stronger, tougher plants, and prevents a breakdown of the primary root and certain other parts of the plant. He suggested that since many soil fungicides for seedling disease control have a high percentage of calcium compounds, it does not seem "unreasonable that perhaps at least part of the benefits obtained from such treatment may be due to calcium."

Cotton in Russia

DR. W. W. Waddle, USDA, Beltsville, Md., member of a U. S. group which visited Russian cotton production areas this past fall reported to the Cotton Production Conference on his observations in the Soviet.

Dr. Waddle told the meeting Russia is a very progressive and aggressive country in the field of cotton production. An increase of some 50 per cent in Russian cotton acreage is planned by 1965. This will come from new land and planned increase per unit of land. Fertilizers, particularly nitrogen and manure, are used extensively,—and essentially all cotton is irrigated.

Contrary to many reports, Russia has insect programs. Insects include bollworms, spider mites, cut worms, aphids, and the hollyhock seed borer. The latter is closely related to the pink bollworm. Available insecticides are used in large quantities, but chlorinated hydrocarbons are not produced in quantity.★★

CASE FOR FIRE ANT

(*From Page* 43)

here out, nor will they suffer losses from this insect. The threat to the health and welfare of our people will be eliminated. This is already the case in several of the states where imported fire ants have been found and will eventually be the case in all of the affected states."

The *Philadelphia Inquirer*, one of the most influential newspapers in the country commented as follows on the criticism of the fire ant control program in an editorial in its November 30th issue: "The need for drastic action is so great that it would be a severe setback to the Nation to delay any step likely to curb the spread of the insects. The fire ants are moving north and west at a headlong rate and aren't going to mark time while Congress debates and interminable tests are conducted.

"In most of its crusades for wildlife the Audubon Society is clearly in the right. But in this instance we believe that some temporizing is necessary. . . . The need for effective weapons agains a menace as serious as the fire ants is too urgent to brook uncompromising obstruction."

From another quarter, *Washington Exclusive*, a newsletter published by the U. S. Press Association in Washington, comes the following comment on the controversy: "In view of the population checks conducted by the U. S. Public Health Service which have failed to detect damage to public health from aerial pesticide spraying, the reports of other public authorities who found no serious or permanent adverse effects on wild life, such a statement (as issued by the Audubon Society criticizing the fire ant control program) can only be decried as a shameful effort to frighten those who are unfamiliar with the fire ant menace and with the care and safeguards employed in the spraying program. As such it is most unworthy of its sponsor."

This source points out that by no means all members of the Audubon Society support the stand taken by the organization in criticism of the fire ant control program. They quote Mr. and Mrs. Thomas Cater, Jr., respectively president and past president of the Middle Georgia Audubon Society, to the effect that over a period of ten years they had noted no effect on birdlife resulting from spray programs to control the white fringe beetle and other pests, and had not observed any reduction in bird populations.★★

AGAINST FIRE ANT

(*From Page* 42)

head of cattle died suddenly there after the area had been sprayed. In the same area Dr. Poitevant also reported that over 100 brood sows had complete reproductive failure following spraying.

In addition to an "adequate" research program the Audubon Society is recommending that in the general public interest, responsibility for control of the distribution and use of toxic chemicals be vested by law in one federal agency, and that this agency be charged with responsibility for keeping the public informed as to

the "true situation" regarding possible hazard to wildlife, livestock, soil organisms and people resulting from control programs.

Report by John L. George

A SOMEWHAT less extreme stand, but nevertheless a definite dissatisfaction with the USDA's fire ant control program, was expressed by Dr. John L. George in a report to The Conservation Foundation and The New York Zoological Society. Dr. George's report, issued early in December, may be summarized in the following set of conclusions which he reached:

"It is unrealistic to think that chemical control of pests will not continue to be an important part of agriculture. It is specially unrealistic to condemn the use of chemicals but to demand perfect fruit, vegetables and grain produced at low cost. In order to survive economically, the modern farmer must commit himself to efficient mass production requiring large capital investment, and pesticides are one of his chief aids.

"However, chemicals cost money, can kill wild and domestic animals, and cause a toxicity hazard to man. Therefore they should not be used merely as a matter of course, but need for their use should be clearly established. With respect to the imported fire ant pest, this has not been done.

"Therefore, we recommend that fundamental biological studies of the fire ant be undertaken by the Federal Government. Knowledge of its parasites, diseases and other natural enemies as well as its environmental needs could lead to the development of less dangerous biological or cultural controls as possible alternatives or supplements to the present use of chemicals. The mere fact that such alternative means of control may take years to develop does not mean that we should concentrate only on the immediate weapon, chemical control.

"Much too little is known about the damaging effects of pest control chemicals upon wildlife resources. In order to evaluate these effects, studies of terrestrial and aquatic populations must be made both before and after an area is treated with chemicals. These must be carried on for at least two breeding seasons, and checked by comparable studies on untreated areas.

"A detailed account of the economic effects of the fire ant is long overdue. Estimates of crop damage have been widely used to show the destructiveness of the ant as a justification for the control program. And yet conflicting evidence is available which indicates that the fire ant does not attack the major crops grown in the South. Until a thorough economic appraisal of the damage caused by the fire ant is completed, the program might well be modified to concentrate on insecticide-fertilizer treatments from the ground which effectively eliminate the ant from

cropland. If, at the same time, only ground equipment were used to treat the peripheral areas where potential spread of the ant is greatest, aerial treatment would be unnecessary. This modification would provide maximum protection for wildlife and domestic livestock without reducing any beneficial effects of the program.

"Few modern problems cut across more lines of scientific inquiry than pesticides. Clearly, the efforts of research biologists should be enlarged to learn far more about the effects of chemical pesticides on natural environments and on fish and wildlife. The biology and ecology of pests also calls for more attention.

"Much more support should be given now to encourage scientific workers in universities and government to investigate these relationships. They need time to study and to consult. They will want to evaluate the economic justification for pesticides in specific cases, and to give more effort to alternate methods of pest control as well.

"Such support is needed now. As agricultural production is intensified to supply a rapidly growing population, pest control operations will also intensify. The ecological knowledge needed to guide them intelligently without damage to the biotic environment is ever more vast and complex. It cannot be gained overnight.

"The use of pesticides presents a most serious challenge in view of the truly tremendous increase in use in the last decade, the highly toxic character of many of them, and possible cumulative effects at sublethal levels. With these considerations in mind, the present limited state of knowledge is very disturbing."★★

BULK DISTRIBUTION

(*From Page* 51)

Co., New York, and Western Phosphates Inc., Garfield, Utah. Fabricated Metals Inc., San Leandro, Calif., built the special equipment. Wilson & Geo. Meyer now is encouraging dealers to join the bulk program. Dealers usually invest $5,000 to $15,000 in equipment but realize a saving by getting a bulk price rather than a bag price for fertilizer they buy. In addition, the dealer makes a profit from his custom applicating service.

All fertilizer manufacturers are watching developments closely, but many apparently feel that the pros and cons are not sufficiently clear at this time or that the trend is not well enough advanced to warrant action.

Local fertilizer manufacturers and some national producers, it is said, view the dry distribution in bulk with misgivings. Mainly, they fear that volume handling will encourage the spread of blender-operators. A new type of spreader, which has separate compartments for three types of material and ap-

plies all three simultaneously to the field, would seem to eliminate the need for mixed-fertilizer producers entirely.

The Wilson & Geo. Meyer plan, called the Anchor Custom Service, after the company's Anchor Brand phosphate fertilizers, features thorough surveys of the individual dealer's existing facilities and potential market. The survey includes a study of the dealer's area, chief crops, customary application rates and times, and length of season. With this survey, Wilson & Geo. Meyer can show a dealer approximately how much capital investment he will need to set up the program and about what his market potential will be.

The company believes that growers are willing to pay for any necessary helpful service and with custom spreading they get a better job of application. The Anchor Custom Service was launched last spring and has been installed in a number of California localities as well as in New Mexico. The firm plans to extend the program throughout the western region. Jeffrey Meyer, vice president and manager of fertilizer sales for the company, said that the plan is applicable within certain capital and market limitations to a great majority of the farm fertilizer retailers. He said that his company is convinced that improved service is the best way to expand sales.★★

SEVIN TESTS

(*From Page* 51)

Sevin in the dust at the rate of one to 1.3 pounds of technical per acre, we kept the weevil population down to an average of nine per cent. The worm population was increasing to dangerous proportions on most of this same cotton until the applications of Sevin were made. Thereafter, counts indicated only a trace of these insects. Bollworm never were a problem for the rest of the season in the treated fields.

The next thing we will be looking for from this new cotton insecticide will be a good liquid formulation. Most of our business in the Delta has switched to spray, because sprays can be applied all day, rather than just mornings and evenings.

Union Carbide, the manufacturer, expects to be able to develop an effective liquid formulation and if it works as well as the dust, we should have a new all-around insecticide for use in this area. According to Louisiana tests, Sevin controls most of the important cotton pests, including fleahoppers, thrips, budworms, boll weevils, and bollworms. Also, aphids did not become a problem on any of our test sites. In one test, we added sulfur to the dust to get red spider control, because Sevin does not stop mites. The mixture was compatible and the manufacturer states that Sevin also is compatible with certain other insecticides and miticides commonly used on cotton.

The Graves Flying Service operates a fleet of 11 planes—four

Stearman dusters, four Stearman sprayers, and two Cubs and one Bonanza for general purposes.

The company is based at Scott Field in Tallulah. From that field, the U.S.D.A. first experimented with airplane application of insecticides in 1922 to control boll weevils moving in from the west and Mexico. In that crop dusting venture, about 30 De Havillands and Jennies were used.★★

ACCIDENTS REPORT

(*From Page* 50)

Cockpit crash pads were not installed in at least 218 of the planes involved in accidents. Of the remaining planes, 44 were reported to have cockpit crash pads. No reports on the pads were received for 101 cases. In three of the cases in which the cockpit crash pads were installed, the pilot was fatally injured.

Crash helmets were reported to have been used in 132 of the accident cases. They were available but not used in nine instances, two of which resulted in fatal injuries to the pilots. Crash helmets were reported not available in 139 instances and no report on them was received for 83 cases. Twice, the helmets broke on impact, and three times they would have been effective if used, according to the report.

Although no figures are given on the amount of flying time devoted to each type of aerial application operation and the items treated, the accidents are broken down to show what was taking place at the time. While the operator was spraying crops 194 accidents were reported, 18 of them fatal. Eighty-seven accidents occurred while the plane was dusting crops, 13 fatal. Among the other types of operations were: fertilizing (21 accidents), spraying forests (13 accidents), and seeding crops (11 accidents).

Ninety-eight accidents were recorded while treating cotton, 93 while treating grain fields, 14 while treating rice, and ten occurred while fruit orchards were being sprayed. Sixteen other crops are listed as being sprayed at the time of an accident and in 78 cases the crop was not listed. These figures, however, are not too meaningful unless it is known what percentage of the total flying hours were spent on each category.

The report concludes with a brief resume of the conditions surrounding each fatal and serious injury accident of 1957, including the date, location, type of aircraft, aircraft damage, and a description of what happened.

The purpose of this report (by the Civil Aeronautics Board), is to furnish pertinent statistics on the number of accidents, accident types, causal factors, and related data for use in accident prevention and safety educational programs.★★

NEMATODE PROBLEM

(*From Page* 41)

golden nematode program started on Long Island, there has been a gradual reduction in the number of new fields found each year. Also the number of cysts recovered per sample since 1947 has been on a decline.

In 1947, the peak year, more than 3,000 new acres in 53 new fields were brought under regulations, but in 1957 less than 300 new acres were found on three fields. Between 1941 and 1958, a total of 13,651 acres has been confirmed as infested in Nassau and Suffolk Counties on Long Island. Since World War II, there has been an increase in homebuilding, particularly in Nassau County. Of the total acres found infested, 7,732 acres have been removed permanently from agriculture, leaving approximately 6,000 acres available for agriculture under the golden nematode program. There are approximately 53,000 acres of potatoes grown on Long Island fields which have been inspected and found to be free of the golden nematode.

Table 1. Efficacy of Mylone 85W for control of the citrus nematode when applied by different methods

Treatment number	Treatment (Mylone 85W)*	Number of citrus nematode larvae per 50 cc of soil from different depths			
		inches 0-12	12-24 inches	24-36 inches	36-48 inches
1.	Non-treated	35 bc**	342 c	134 bc	105 b
2.	Mylone rototilled	82 c	736 c	339 c	135 b
3.	Mylone — rototilled + 2 inches water	0 a	244 c	348 c	165 b
4.	Mylone — rototilled + 4 inches water	0 a	104 ab	152 b	34 ab
5.	Mylone — rototilled + 6 inches water	0 a	0 a	0 a	0 a
6.	Mylone — rototilled + 8 inches water	4 ab	1 a	0 a	0 a
7.	Mylone — rototilled + 10 inches water	21 bc	26 ab	0 a	0 a
8.	Non-treated, 6 inches water	23 bc	331 c	418 c	129 b
9.	Mylone in 2 inches water	1 ab	332 c	227 c	25 ab
10.	Mylone in 4 inches water	0 a	109 bc	133 bc	19 ab
11.	Mylone in 6 inches water	0 a	0 a	0 a	0 a
12.	Mylone in 8 inches water	0 a	0 a	0 a	0 a
		0 a	0 a	13 ab	6 ab

*Mylone 85W was applied at the rate of 470.6 pounds (400 pounds of active ingredient) per acre.
**The letters designate similar groups at the 0.01 level of probability. The probability for each sample depth has been calculated separately.

CITRUS NEMATODE

(*From Page 59*)

2, in the second foot of soil. *P. citrophthora* was obtained from treatment 2 in the first- and second-foot zones, treatment 4 in the second and third feet, treatment 9 in the first, second, and third feet, and treatment 10 in the second and third feet of soil. Neither species was obtained from the top 3 feet in plots where 6, 8, or 10 acre-inches of water was used, either as carrier for Mylone (treatments 11, 12, 13) or for irrigation after the chemical had been mixed with dry soil (treatments 5, 6, 7).

Weed Control: There were no weeds on plots treated with Mylone applied dry and rototilled into the surface soil (treatment 2, Table 1), or applied in 2 or 4 acre-inches of water (treatments 9, 10). In treatment 2 (2 acre-inches of water after rototilling) and treatments 11, 12, and 13 (Mylone mixed with 6, 8, and 10 acre-inches of water), only a few weeds appeared. Control was not good in other treatment plots. Washing out of the chemical from the surface layers by water applied after Mylone was mixed into the soil may have been responsible for the poor results in these plots.

BIOLOGICAL CONTROL

(*From Page 43*)

3. The necessity of maintaining the pathogen in a viable condition, at a high virulence and in a resistant state until the insect is contacted.

4. The difficulty of producing some pathogens either in large quantities, inexpensively, or both.

5. The tendency of some diseases to cause portions of the insects to remain attached to the foliage of the host plant.

6. The requirement of some pathogens, notably most fungi, for high atmospheric moisture in order

to invade and infest their insect host. On the other hand, most bacteria, viruses, and protoza are ingested, wherein the body fluids of the host insect provide an ideal environment for development. Temperature may also be important; however, conditions favorable to the host insect generally are favorable for the development of the pathogen.

Although some of us think that the insect viruses may eventually become our best microbial control agents when the production bottleneck is solved, the breakthrough of living insecticides into the commercial insect control picture has started in this country with the interest displayed by a number of concerns in the production of the spore-foaming bacterium, *Bacillus thuringiensis* Berliner. This bacillus has all of the attributes of a good microbial insecticide. It is a quick-acting organism that is easy to produce and the resistive and toxic stages do not lose viability with extended storage. Unlike many bacteria, it does not lose virulence with repeated growth on artificial media. Recent extensive tests have confirmed suspicions that the organism has no effect on warm-blooded animals. With its use, the matter of toxic residues would be no problem. It is water-miscible and therefore can be applied as a spray or a dust.

Bacillus thuringiensis has a wide range of susceptible hosts and this range is expected to increase as tests are made. In the western United States, the alfalfa caterpillar, the cabbage looper, the imported cabbageworm, the diamondback moth, the salt-marsh caterpillar, the cotton leaf perforator, the celery leaf tier, the Egyptian alfalfa weevil, and the lima-bean pod borer are known to be at least moderately susceptible. Laboratory tests have shown that some of these insect species are much more susceptible than others, and it is expected that the field dosages for effective control will follow the same pattern.

For some unknown reason, many industry representatives have acquired the belief that the bacillus will come into general use at dosages approximating one gram of high potency material per acre. We consider this to be an extreme error of over-optimism. Although field testing has been limited to date, there are indications that the dosages eventually may be established at levels as low as one to two ounces of high potency material per acre for the alfalfa caterpillar and as high as one-half to one pound per acre for the cabbage looper. It is our belief that the bacillus will not be usable in the field against insects less susceptible than the cabbage looper, and acceptance of the organism for use in the control of the looper will depend upon the ultimate cost of the material.

In closing, I would like to state that microbial control offers no

panacea for the control of destructive insects. It should not be oversold or advanced as a cure-all, since in many situations it has definite limitations that will preclude its use. On the other hand, the potentialities of microbial control should not be underestimated. The production of microbial insecticides is in its infancy. It is at about the same stage of development as that of the first industrially produced chemical insecticide that entered the market a great many years ago. We are starting with one material at this time. However, if *B. thuringiensis* is a success, undoubtedly more microbial materials will follow. Some of them should find a place in the various programs for the control of pest insects.★★

SUPER PHOSPHATES

(*From Page* 43)

contact between the rock and acid is the main requirement for conversion to take place. Why not equip a spreader truck or some other spreading machine with an acid tank, and mix acid and rock just before it hits the spreading mechanism, or, at least before it hits the ground? Developing such a rig would present problems. However if a spreader truck, a "jackleg" mechanic, and a source of acid ever got together, the difficulties might be worked out. We are convinced the material produced would be satisfactory from an agronomy standpoint. Furthermore, the savings effected would probably make field acidulation attractive to the farmer. ★★

NEW PESTICIDES

(*From Page* 40)

LD_{50} of 482 mg/kg; tests show no dermal absorption or dermal irritation for application of one mg of pure PRD per kg of body weight in albino rabbits.

Other experiments show that PRD does not exhibit systemic properties as a nematocide, nor does it have the ability to kill root-knot nematodes in living infested roots. It compared favorably with Nemagon and Vapam in greenhouse tests against root-knot nematode.

Dimethoate

A new experimental parasiticide demonstrating marked efficiency in controlling nasal botflies that attack sheep, was reported on by USDA researchers this year. The chemical is not yet available to livestock raisers, and its general use has not yet been recommended.

Injected into the muscles of sheep at the rate of 25 milligrams per kilogram of the animal's weight, this systemic organophosphate compound produced an overall kill of 97% of nose bots (*Oestrus Ovis*) in USDA tests.

No toxicity from the chemical occurred in any of the treated animals. Selection of the dosage was made after six preliminary experiments.

Dimethoate's effectiveness against botfly grubs in the second and third instar stages is especially notable, USDA scientists say. The only other organophosphate systemic tested—ET-57 (Trolene)—was about as effective as dimethoate against first instar grubs but had little action on older instars.

Dimethoate was discovered by industry chemists and was originally intended for use against cattle grubs. However, it has not proved as safe or efficient as ET-57 for cattle-grub control.

2,3,6-Trichlorobenzoic Acid

A new group of herbicidal compounds based on 2,3,6-trichlorobenzoic acid is being made by the Heyden Newport Chemical Corp., New York. Herbicides based on the new compounds are said to show outstanding promise for control of bindweed and other deep-rooted perennial weeds in agricultural lands and industrial areas.

(*To Be Concluded*)

ROUND TABLE

(*From Page* 38)

A. J. Sackett, pointed out that with wages on a steady increase for the past 15 years, during down time, employees earn considerably more than the cost of the repair. "There is no such thing as a 'minor' stoppage," he emphasized, and comment from other participants reiterated this view. The cost of breakdown is potentially tremendous. Stoppages coming at peak production periods can make customers go elsewhere permanently, and the tonnage lost under such circumstances may never be regained.

S. S. Shelby, Federal Chemical Co., indicated that a program of servicing, inspection, detection, and correction is a method of saving time, labor, expense, and increasing efficiency of production. Down time, he reminded, results in damage to the product, since a good granular product results only from an "on stream" operation. Down time costs more than just stopping, —it causes damage to the adjacent parts of the damaged equipment.

Preventive maintenance, said W. E. Schaffnit, Stedman Foundry & Machine Co., is a program of good housekeeping, replacement of machine parts before they break down, and a regular program of clean-up, greasing and general inspection. Manufacturers of equipment issue charts on the care of their equipment, — but 80% of buyers pay no attention to these instructions, — don't read them when the equipment is purchased, and never look at the chart. Too much grease, for example, is as bad as too little grease, he pointed out. Yet so many so-called maintenance men will put five times as much grease on high speed equipment, which results in heating — in cold weather, too much grease results in setting and hard starting. Most plants let the fertilizer elevator chains run until they break. He suggested that a record be kept of installation and tonnage operated, and the chain inspected and replaced on a definite schedule. Good housekeeping, said Mr. Schaffnit, is the main point to stress in preventive maintenance.

The Dust Collecting System

F. A. RETZKE, Smith Agricultural Chemical Co., discussed a dust collection program and how it contributed to a preventive maintenance program. Describing a dust collection program for a granulation system, Mr. Retzke reported on tests in which 1710 pounds per hour of dust were collected (440 pounds by dryer collectors and 1270 pounds by cooler collectors). Estimating that the dust was valued at $20 per ton (cost of normal superphosphate) the value of the dust recovered was about $17.10 per ton. Then, based on a finished product rate of 20 tons per hour, this would convert to 85.5 cents per ton of finished product. And, for a plant producing 40,000 tons per year, this would equal about $34,200 per year on an investment of about $15,000 for these collectors.

This is only part of the story, however, said Mr. Retzke. The collectors were only 90% efficient, and to meet city air pollution codes, the 10% of dust escaping had to be controlled. To collect this final 10% considerably more expensive equipment was required. Secondary collectors removing half of the dust escaping from the first system might cost as much as $35,000, — but if health codes are to be met, a company may have to adopt some similar program of dust (or fume) removal to continue operations.

Construction Materials

IN an exchange of comment, J. Campbell and A. Webb, of Haynes Stellite Co., reported on properties of two nickel-cobalt based alloys, and suggested that they might be used as construction materials in areas of severe corrosion. Hastelloy C, a 54 nickel-16-molybdenum-15 chrome and 4-

tungsten alloy, resists corrosion of sulfuric and phosphoric acid at temperatures up to 150F. Hastelloy D, (82 nickel - 9 silicon - 3 chrome) suggested for high temperature applications resists concentrated sulfuric acid at all temperatures and all concentrations. Limitations of alloy D are that it is available only in cast form and has limited machineability. Alloy C is available in cast form, raw formings, wire, foil, valves and pumps.

Several members of the Round Table in 1957 reported they were trying the Hastelloy metals in their plants. At this 1958 meeting one speaker indicated he had used an installation of Hastelloy C as a sparger, and that thus far some 50,000 tons had passed through the sparger without corrosion. Another fertilizer plant operator indicated he had passed some 30,000 tons through a "C" sparger.★★

FOREST PESTS

(*From Page 88*)

normal situation and a normal one? Since most forest pests are native to the forest environment, they occur in varying numbers in all areas, being most dense in the center of an epidemic, and gradually decreasing away from an outbreak until the normal situation is reached. The important consideration is to recognize the trouble spot, and to encompass it in its entirety in the treatment program.

A different type of special problem, directly related to the pesticide operation itself, is to assure that the correct formulation and dosage of pesticide is being used. This is especially important in aerial spray jobs. The old adage, "if a little is good, more is better," has no place in applying pesticides.

Summary

WE recognize that there is some degree of hazard connected with the broad scale dispersal of insecticides by airplane. Hazard depends upon the dosage, manner in which insecticides are used, and the frequency with which they are applied to a given area. We know that insecticides are toxic to some forms of life other than the insects under attack, and that if sufficient amounts are used, serious consequences can result. Insecticides are poisonous, just as the drugs we take in pills are poisonous when not used in accord with directions. An overdose of many beneficial things can be dangerous. This is as true for insecticides as for medicines.

However, we are convinced from our record in spraying DDT from airplanes, an experience that extends over 10 years and involves more than 10 million acres of forest land, that where insecticides are properly applied by trained people in accord with a carefully prepared, predetermined plan, damage to fish and other forest life will be well within acceptable minimal limits.

While important strides have been made in control of forest pests, progress is not yet geared to the magnitude of the situation. The battle of bugs and blights is not yet fully joined. Success in reducing forest insect and disease losses cannot be obtained by any one method. Instead, it can be achieved only by skillful coordination of preventive and suppressive measures. The first line of defense against many forest pests is a thrifty forest. The support of a public enlightened to the seriousness of the problem is also needed to secure increasingly better control programs. Above all, material to scientific advances are needed in evaluating abnormal forest pest conditions, and in developing methods for controlling many forest pests, for which effective controls are not now known.★★

OREGON MEETING

(*From Page 88*)

Karathane sprays to test its effectiveness against yellow rust and fruit rot. There was no synergistic action from combining the two materials, according to Vaughan.

Rapid build-up of spores was

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Rapid build-up of spores was

blamed for reduced effectiveness of the fungicides later in the season. Early sprays during the blossoming period are the most effective, the studies reveal.

Presence of a minute quantity of copper in the nectar of a pear blossom prevents growth of the pear blight bacteria, so very weak (½-½-100) Bordeaux spray is effective in checking the disease. This was the report of H. J. O'Reilly, University of California plant pathologist from Davis, who was telling of work done in that state.

A spray or dust program in which copper is applied frequently at short intervals to newly-opened blossoms holds blossom infection to a minimum, he declared. Five-day intervals during warm, moist weather, or 10-day intervals in dry weather have been found effective under California conditions, he explained.

Many successful growers wait until from 20% to 30% of the blossoms are open, if temperatures are low enough so bacterial development is delayed, and insect activity is reduced. From 8 to 13 applications are often made to control pear blight in California — the last application to catch "rat tail" blooms opening several weeks after the main bloom.

If copper sprays or dusts do not exceed one pound of metallic copper per acre per application, fruit russetting has not been excessive. An application of 800 gallons of ½-½-100 Bordeaux, an amount seldom put on in one spray, would be necessary to exceed the limit.

Antibiotics, including various formulations of streptomycin and terramycin, that have been used with success for blossom blight control, do not appear to be eradicative in their action, he remarked. They fail to arrest movement of blight bacteria that have already entered the blossoms and shoots. These antibiotics must be applied at the same five-day intervals that are required for copper sprays.

In areas that have shorter blooming periods, like Oregon, more blossoms open in a given period. In these areas it may be necessary to make applications more frequently, O'Reilly pointed out. (He was state extension plant pathologist in Oregon until he joined the University of California staff several years ago.)

Toxic substances developing in the soil following heavy applications of chemical nitrogen could be one of the causes of "pear decline." This baffling ailment that sometimes results in a tree changing from moderately healthy to completely wilted in 24 hours, has been studied intensively for years by teams of scientists in Oregon and Washington, but no positive solution has been discovered.

Henry Hartman, emeritus head of the department of horticulture at Oregon State College, offered the toxic substance hypothesis during a panel discussion of pear decline. Discoverer of the Hartman wrap and other treatments which saved the western pear industry in earlier years, he recently was given the assignment of trying to unravel the "decline mystery."

From 20 to 25 pounds of ammonium sulfate—or the equivalent—often is applied per tree, he reported. Some orchardists have been known to put on as much as 40 pounds in a six-months' period, according to Hartman. Irrigation of orchards in the Rouge River Valley often is by flooding, with water frequently standing around the trees for days. This sealing off of the oxygen supply could be one of the causes of decline, the speaker suggested.

It was on similarly ailing pears, as well as orchard trees bordering highways where maintenance crews had used 2,4-D and other weed killers that Gentner observed variations from the expected insect control with materials he had under test.

It is estimated that approximately 1000 growers attended the various sessions.★★

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EDITORIAL

(*From Page 27*)

schedule the meeting in a city that is readily accessible by air and rail, and in a hotel whose facilities are adequate to handle the group. This writer has attended some meetings in mighty out-of-the-way places and stayed in some painfully inadequate quarters. Well remembered is one bleak three-days in a student dormitory, and another sub-zero session in a "tourists accomodated" set-up. Also several conventions conducted in isolated outposts where there was no laundry or valet service, and only a single telephone line to the outside, — always busy.

Let's hope that meeting chairmen will make a New Year's resolution of their own that for '59 they will schedule their meetings only in places that are readily accessible, and in hotels that can actually handle the numbers they expect to attend.

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N. P. F. I. NEWS

IN THE SOUTH

S. C. Discusses Soil Fertility

Efficient crop production and how it can be attained through sound management practices and high soil fertility were featured topics at the annual meeting of the South Carolina Plant Food Educational Society held in Clemson, November 24, 1958. The meeting was attended by approximately 125 persons representing the various agricultural interests in South Carolina.

Mr. Robert Edwards, acting president of Clemson College, emphasized the importance to South Carolina of the soil fertility program which has recently been established in that state.

S. L. Tisdale, Southeastern Regional Director for the National Plant Food Institute, discussed the Institute's interest in supporting the soil testing program which has recently been gotten underway in Edgefield County. He was followed by Mr. Hugh Woodle, extension agronomist, who outlined in detail some of the accomplishments of the Edgefield County program as well as some of the specific objectives which they had in mind.

Support to N. C. Project

The National Plant Food Institute, through its Southeastern regional office, has completed arrangements with the North Carolina Agricultural Extension Service to support a pasture demonstration program in 10 counties throughout the state.

The project is aimed at demonstrating sound pasture seeding, maintenance and management practices, and the Institute is providing a $2,500 grant to support the program for the fiscal year ending June 30, 1959. The Institute contract with the Extension Service is subject to renewal on an annual basis.

Establishment, fertilization, maintenance and management of all forages including permanent and temporary pastures, hay and silage crops is planned. The demonstrations will serve (1) as a means of showing farmers the production possibilities from using all improved production practices, (2) instruments in training county agents, (3) materials for field meetings, and (4) sources of possible surveys among those attending the field meeting and viewing the demonstrations.

TV Group Honors Wilson

Louis H. Wilson (left) Secretary and Director of Information for the National Plant Food Institute, is shown receiving the "Meritorious Service Award" of the National Association of Television and Radio Farm Directors, at its fifteenth annual convention in Chicago on November 30.

The highest honor accorded by the Association, the presentation was made by NATRFD President Robert C. Miller, Director of the Farm Department, Station WLW, Cincinnati.

Soil Test Project in Alabama

A $2,500 grant has been awarded by the National Plant Food Institute to the Alabama Agricultural Experiment Station at Auburn to support research directed at improving soil test methods.

"Fertilizer applied in accordance with soil test recommendations returns millions of dollars in added income to Alabama farmers," said Dr. S. L. Tisdale, Southeastern Regional Director of the Institute. "We are anxious to help in every way possible in the carrying out of this work."

The project, which is to commence January 1, 1959, is under the direct supervision of Dr. R. D. Rouse, Soil Chemist and Director of the Soil Testing Laboratory at Auburn.

Complete Virginia Plans

Plans have been completed for an intensified soil testing demonstration in three counties in Virginia, sponsored by the NPFI in cooperation with the Virginia Polytechnic Institute.

Counties selected for the program are; Southampton County, in the Coastal Plain area; Pittsylvania County in the Piedmont area; and Russell County in the Blue Ridge area in Southwestern Virginia.

The program begins with a one-week course for professional agricultural workers on "Knowing Your Soils." The second phase deals with using and managing soils. All farmers in the counties are encouraged to take soil samples.

IN THE WEST

Accident Prevention School

Ways and means of handling fertilizer safely were discussed at the first school on accident prevention in the fertilizer industry to be held in the Far West. The two-day school, held December 2nd and 3rd at Fresno, California, was jointly sponsored by the Fertilizer Section of the National Safety Council and the National Plant Food Institute.

"If you discover the hazard, the correction can be found," W. C. Creel, North Carolina Department of Labor, and safety director of the council, told school participants. Mr. Creel recommended regular plant inspection and accident investigation as basic to discovering accident hazards in fertilizer plants.

Highlights of the school included a panel discussion on the safe handling of liquid fertilizers, a group discussion on the problems which participants would like to have solved, and addresses by other members of the industry and safety organizations.

O. J. Chinnock, Hercules Powder Company, presided as school director. Dr. Richard B. Bahme, NPFI Western Regional Director, acted as school secretary and treasurer in preparing and setting up the session.

INDEX to ADVERTISERS

TALE ENDS

IT may not be too long before aerosol-type powdered plant pesticides will be on the market. There are of course a long list of liquid aerosol insecticides being sold, but up until now problems in valve functioning have prevented the successful introduction of powdered aerosol pesticides.

Clogging and leakage are the two problems. Clogging occurs when particles of powder build up in valve restrictions, blocking the valve passages. When the powder particles build up on valve seats, the valve does not shut off as it should and leakage results. The only way around the two problems has been to limit the powder content to no more than 10% - and this low percentage has precluded the aerosol packaging of efficient pesticidal powders.

Development of improved dry powder aerosol formulations may provide the answer. If an appropriate suspending agent can be found, it would then be possible to suspend the dry powder as a colloid in the propellant, which would make successful use of present valve designs possible. Look for a new group of powdered aerosol pesticides as soon as this problem is solved.

The granular idea has certainly gone over in a big way right straight across the agricultural chemical field. In addition to the success of granular fertilizers, the granular idea has gone over equally well in the insecticide and in the herbicide field. One of our secret agents reports that three or four granular herbicides designed for pre-emergent use in corn will be on the market next season. He also reports that two of the three new products registered for control of onion maggot are produced as granules. Incidentally, because of the growing problem of resistance of onion maggot to the chlorinated insecticides, onion growers throughout the U. S. and most of Canada will apparently have to depend primarily on phosphates for control during the '59 season.

AC

Microbial insecticides are reported to be promising for rather extensive future agricultural use on the basis of test work in the field this past season. Field control of numerous pests was obtained with both wettable powder suspensions and dust formulations. Indications are that microbials are particularly promising for use on maturing fresh market crops like cabbage or lettuce, and forage crops like alfalfa. There are said to be unique problems, however, of residues, product standardization and the job of successfully integrating the microbial products with other insecticides in the spray schedule. Most important, is the need for large-scale field testing with some really good formulations. **(Story on Page 45).**

AC

Professor F. J. Morrow, research chemist and teacher at Fairleigh Dickinson University, Rutherford, N. J., has banned from the cafeteria kitchens of the university all fruits and vegetables sprayed with DDT or other insecticides. "The foods we previously served were within the insecticide tolerance limit set up by the FDA," he said, "but I feel there should be absolutely no such content in food served to humans."

The university now is buying its food from two farms, which raise crops by "organic feeding". This enables the plants to grow healthy enough to resist insects on their own, Prof. Morrow claims. Just what valid evidence the professor bases this theory on, he doesn't say. We have looked long and hard for any such scientific evidence in the literature, without ever finding a shred of support for the idea.

As long as we are in the realm of hypothesis rather than fact, however, we offer our own speculation: two will get you four the good professor is an organic gardener.

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